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Popular clamor for the recall of a judicial decision prohibiting the granting of aid to a railroad company is the mixed situation in Colorado as the result of the decision by the state Supreme Court that the contract under which Denver was to furnish $3,000,000 for building the Moffat tunnel was not constitutional. Colorado's constitution prohibits a city lending its credit directly or indirectly in aid of any corporation or entering into a partnership with a corporation or of making a donation to a corporation. After the bankruptcy of the Denver, Northwestern & Pacific, Newman Erb undertook to reorganize the company as the Denver & Salt Lake, and persuaded the city of Denver to issue $3,000,000 bonds to pay for two-thirds of the cost of the tunnel which will make possible the extension of the Moffat road, which now runs from Denver to Steamboat Springs, to Salt Lake City. Denver has voted three times by a substantial majority to make a municipal bond issue to build a tunnel and to let railroad companies use the tunnel. The Supreme Court of the state, however, has held that this amounts to entering into a partnership agreement with a corporation and lending aid to the corporation. When this decision was announced there was a clamor for a recall, which is provided for in one of the amendments to the Colorado constitution. As it is pointed out, however, by Colorado lawyers commenting upon the decision, the recall provision may not apply to this particular case, and even if it should eventually be found to do so, the Denver city bonds, if issued immediately with the ban of the Colorado Supreme Court upon them, could not be sold. It may even be possible that the state of Colorado, in its effort to tie its own hands against aid or comfort to the enemy corporations, has very effectually done its utmost to prevent the entrance of a new railroad competitor into the transcontinental freight business with resulting loss to the rest of the United States.

Colorado and the Moffat Tunnel

The Interstate Commerce Commission has issued in abstract its customary statement, for the year ending June 30, 1913, of the total mileage, equipment, capital, and revenues of all roads in the United States earning more than $100,000 each, together with traffic statistics and the number of persons in the companies' service. The main features of this abstract are reproduced on another page. There has also been issued this week the "text" of the commission's final statistical report for the twelvemonth ending one year before that, or June 30, 1912. This is dated November 17, 1913. The term "text" is used to denote the statistician's introduction to the report, which embodies the tables that give aggregates for the whole country. This matter fills 65 pages. The final unabridged report—the bound volume, costing a dollar—may be expected some time in the future. The efforts of the statistical office of the commission to get out the annual statements as early as possible—while the facts which they give are still of some current value—are very commendable; but the task is one of such magnitude that evidently it is difficult to decide what to do first; and the effect is slightly bewildering. One who wishes to use the statistics needs a schedule of dates as elaborate as a court calendar. First comes the brief report of income account for roads having annual operating revenues of $10,000,000. This, for the fiscal year ending June 30, 1913, came out with the commission's annual report to Congress in December last. Next, revenues and expenses of roads of Class 1, those earning over $1,000,000 each. This also came in the December report. This is only a half-page statement, based on monthly reports. Next, a pamphlet of 179 pages giving full, but uncorrected, statistics of each road in Class 1. This contains all the different classes of statistics, but no totals for the country as a whole. This, for the fiscal year 1913, is dated January 1, 1914, and reached this office in April, 1914. Next, the totals for the country for the year of all roads having each an annual

Statistics of Varied Vintages

revenue of $100,000 or more (Classes 1 and 2). This, for 1913, filling a half dozen pages, is dated July 1, 1914, and is the one reprinted by us today. It deals with a variety of statistics, as noted above; but it gives no information about individual roads. It is "preliminary"—subject to correction—and also is incomplete in that it omits Class 3 roads, those earning less than $100,000 each. The final report for 1913, giving individual statements for all roads, and the corrected totals for the whole country, is yet to come. This final report for 1911 has been out several months. For 1912 a part of the final report (the "text" above referred to)—facts two years old—has just come out, and the remaining part may be expected within from six to nine months. This for 1912; the final report for 1913 will be due twelve months after that. As to the fiscal year 1914, which has just ended, all that can be said is that the year "has passed into history." But getting facts out of history is quite a different matter!

A New Leaf on the Western Maryland

Expenses for May on the Western Maryland were 114 per cent. of gross earnings. Carl Gray became president of the Western Maryland in March, and the very heavy expenditures and charges for maintenance in April and May are the result of a drastic policy of cleaning up deferred maintenance. June expenses are expected to be as heavy as those of May. In May, 1914, $181,000 was spent for maintenance of way as against $96,000 in May, 1913, and $266,000 for maintenance of equipment as against $107,000 in 1913. The management announces that part of the heavy maintenance for May is in extraordinary repairs to roadway and locomotives, but a considerable portion is due to an inventory shortage which was discovered at the time of the change in management. Previous to the change in management, the Western Maryland had been making a very poor showing, and it now appears that even this poor showing was better than the actual facts warranted. The improvement in the ratio of transportation expenses to revenue in the last few months is marked. The ratio in February was 58 per cent., in March 51 per cent., in April 43 per cent., and in May 41 per cent. The new management expects that June will be the last month of the extraordinary charges necessary to put the property in good physical shape, and to clean off deferred charges. The Western Maryland has been playing in hard luck ever since it was singled out to become the eastern outlet for the projected Gould transcontinental system. When this project fell through, the necessities as far as the Western connections of the Maryland road were concerned were met by the construction of the Connellsville line to connect with the Pittsburgh & Lake Erie, which it was thought would supply a very good outlet to the East for the shippers of steel and similar commodities along the line of the latter road and its connections. The advantages that should have followed the opening of this line have not as yet materialized, but it is beginning to appear as if this was due rather to serious mistakes of the old management than to the impossibility of securing large and important amounts of traffic from this connection. Apparently the newly elected management of the Western Maryland is going about bettering conditions in the proper way.

Safety at Grade Crossings

A simple and sensible method of dealing with one of the important factors in the highway grade crossing problem, which promises to produce immediate results, has recently been adopted by the Cook county public safety commission of Illinois. The grade crossing question has been constantly agitated in Illinois for several years, as in most other states, and the railways have already expended many millions of dollars for track elevation and other improvements, not only in the cities, but throughout the rural districts. The grade crossing committee of the safety commission, however, has hit upon a way of removing dangerous conditions at hundreds of highway crossings where the situation does not demand or warrant heavier expenditure, but which present serious possibilities to automobile and other vehicle drivers. This committee, accompanied by the county coroner, himself a former railroad man, has recently made a number of inspection trips over the lines running out of Chicago, and has discovered scores of places where the principal requirement is the removal of obstructions to the vision of pedestrians or drivers of vehicles on the highways approaching the crossing. In most instances the obstructions are not upon the property of the railway, but consist of trees or shrubbery that could easily be removed or trimmed to give a clear view of the railway track for some distance from the crossing. The committee has been accompanied on each of these trips by officers of the railway and by the mayors or other officials of the cities and townships through which the line passes, and both the railway men and the public officers have been easily persuaded to undertake the slight expense involved, or to co-operate wherever necessary to remove the dangerous obstructions at once. Thus the cause of safety has been promoted at the cost of very little money simply by bringing the right people together and pointing out to them how simply conditions may be remedied and at how little cost.

A SENSATIONAL REPORT ON A STALE SCANDAL

IT is significant that the report of the Interstate Commerce Commission in its investigation of the financial transactions of the New York, New Haven & Hartford, which is abstracted at some length elsewhere in this issue, is signed, not by any individual member of the commission, but, like the reports on overcharge claims amounting to $50 or thereabouts, "By the Commission." The facts brought out by this investigation should have been brought out, and if it is possible for the New Haven stockholders to recover any part of their money which has been spent illegally, court proceedings should be begun at once. But the method of bringing out these facts which has been followed in this report is so grossly improper that the only charitable assumption is that the commissioners were so taken up with the rate advance case that the preparation of this report was left to Mr. Folk or to others who took this occasion to make a play for popular attention at the expense of the common decency of the commission.

Frederick W. Whitridge, president of the Third Avenue Railway, of New York, in commenting on the New Haven report, is quoted as calling it the exposition of "a stale scandal." During the greater part of the time that this scandal was being actually enacted, the Interstate Commerce Commission was charged with the duty of regulating the management of the railroad companies of this country and clothed with plenary power, and during the time that the accounting irregularities, which quite properly are so bitterly commented on by the commission, were being carried on, the commission was accepting without comment the New Haven's monthly and annual statements showing its financial transactions. The commission had the legal power to make an investigation of these accounts at any time. The commission therefore lays itself open to the charge of being simply a destructive critic, where it might conceivably have prevented some of the waste and loss that has taken place.

It is unnecessary for the *Railway Age Gazette* to comment on the negligence of the directors of the New Haven, or on Mr. Mellen's ethical attitude toward the stockholders other than the late J. P. Morgan—most of the facts that the commission so sensationally blazons forth in this report were already public knowledge from the testimony at the hearings. On the other hand, it is entirely fair and pertinent to ask the commissioners whether or not, by giving their stamp of approval to the New Haven's annual reports for 1908-09-10-11 and 12, they are tarred at least in some measure with the same brush which they wield so vigorously against dummy directors.

THE AUTOMATIC TRAIN STOP—II

IN discussing in our issue for July 10 the report of the American Railway Association Committee on this subject, we rehearsed the arguments concerning the excellence of the train service on American railroads and those evidences of progress that the principal roads are making in safety measures, which tend to justify that committee in holding that automatic stops are not at present to be recommended; and we called attention to those difficulties connected with the stop problem which support the view that the general adoption of this safeguard would be so costly, compared with the value of the expected protection, that the expenditure would not be warranted.

But there is another side to the question. The safety of American railroad trains is excellent, but it is not perfect. There is progress in safety, yet collisions continue to occur often enough to keep fresh in the railroad manager's mind the fact that this progress is halting and in many cases slow and imperfect. Dependence on improved vigilance on the locomotive, which is a main feature in this committee's theory, is not a wholly satisfactory safeguard. Engine runners occasionally disregard signals because of defects or deficiencies of mind or body which, it is admitted, are incurable by any process within the control of the railroad superintendent, and the idea of perfecting some device outside the engine, to stop it when the runner fails to do his duty in that respect, has therefore appealed not alone to congressmen and to ambitious inventors in secluded laboratories, but to hard-headed railroad officers as well. And when the failure of an engineman results in a score of deaths, the public demands a cure of the evil at any cost (except at the cost of low speed—nobody proposes that as a remedy). The arguments in favor of automatic train stops therefore merit attention.

The main point in favor of automatic stops is that they are extensively used already, on the underground railroads. The Interborough (New York) has used them nearly 10 years and the officers of the company class them as a valuable safeguard. The differences between the Interborough subway and ordinary railways are matters of detail; very costly and troublesome details, perhaps, yet details. The public cannot be convinced that mere details should warrant a trunk line in ignoring the experience of the Interborough except after a thorough demonstration. After a five years' demonstration on the Interborough, the Hudson & Manhattan, the Pennsylvania tunnels and the London tubes adopted the stops. The system is no mere experiment. On these roads, it is true, the motorman has no companion in the cab (except on the Pennsylvania), but there is little force in the argument that a monitor makes the automatic stop unnecessary, for the reason that our fireman-monitors have so often failed. Two men will forget together. On freight trains eight men have coincidently forgotten a despatcher's order.

If anyone is disposed to argue that these city roads need stops because their motormen are not high grade men, like regular locomotive runners (and that roads employing firemen do not need them), he may as well dismiss the question, for it is not a practical issue. "High-grade" is an unreliable term. Mr. Rudd's appeal to the honor and the conscience of the engineers will not afford us any satisfaction. Not that the majority of runners are devoid of honor and conscience; the question is, can the superintendent be sure of the right qualities in the whole of his force? He, as an individual, is responsible for efficiency. Exhorting the units has no tangible effect. One of the hardest problems of the superintendent is to cultivate, in enginemen, that brand of conscience which will admit a mistake when the result of that mistake may mean dismissal. Again, the directors of a large railroad, when considering the problem of perfecting their enginemen, must recognize that their superintendents—perhaps a score of them—are far from perfect. They will not always get 100 per cent. out of their runners even if the making of the 100 per cent. is there. A big railroad is such a complicated machine that no one has yet got near the ideal in operation. For many of the elements of many of our good records we have to thank a benevolent Providence rather than scientific efficiency.

It is not all a question of discipline, however. The most perfect enginemen, under the best administration, may break down. Mr. Long, the general manager of the Pennsylvania, speaking at the meeting of the American Railway Association last year, mentioned collisions that he had heard of which were due to "preoccupation of the engineman." The man was awake, had his head out of the cab window, looked at the signals, saw them, but did not obey them. The sense of sight was not sufficient. Many people, said Mr. Long, think that cases like this are becoming so frequent that something ought to be done. Every one knows that enginemen sometimes go on duty with powers of mind or body impaired by sickness, or with minds burdened with debts, or divorce or other domestic difficulties, or the death of a friend. They have not the combined courage and discretion to lie off and lose a day's pay. The wisdom described by some of the writers of our articles, published last winter, on "How to Keep a Good Lookout" is not universal. With the mass of facts like the foregoing, it would be easy enough to show that automatic stops are desirable if only they were proved practicable and not unreasonably costly.

The Interborough not only uses the stops but recommends them. In the first year a very serious collision was undoubtedly prevented. On the Boston Elevated, where stops have been used 15 years, an officer gives the significant testimony that disregard of stop signals *has been done away with.* With its low speeds this road has not the most difficult problems, but it is noticeable that the fine results reported have been made without the aid of a recording apparatus. And here, as well as on all the subways mentioned, the stops are not self-detecting. It is possible for a stop to fail and the failure not be promptly discovered. But the improvement of discipline is such a pronounced benefit that the officers prize the system highly without demanding that it shall be ideally infallible. On the Interborough a satisfactory degree of certainty in operation is maintained by the ordinary inspection, such as is given other signal apparatus.

There are bold signal engineers ready to adapt automatic stops to trunk line railroad conditions. The Chicago & Eastern Illinois, as noted in the *Railway Age Gazette* June 5, page 1,246, has equipped 90 engines, and proposes to protect trains on about a hundred miles of road. Unless some fairy can give assurance that no more collisions of the first magnitude are going to occur anywhere, it would seem to be the duty of railway officers generally to keep very close track of all such experiments as this; or, if those experiments are not in all respects of a satisfactory kind, to start something better. And when we see the underground roads satisfied with a device which theoretically is imperfect, and the French government requiring cab signals installed on thousands of miles of road, it may be claimed, with reason, that sticking forever at the difficulties of the automatic stop, is not the part of wisdom. One of the difficulties, the overlap, can be overcome by adding "speed control" apparatus. Why should not speed control be thoroughly tested? All troubles with snow and ice are supposed to be avoidable by the use of magnetic or induction apparatus, having no contacting parts. Should not this supposition be proved? If brake-applying apparatus is to be finally rejected as not usable, the fact ought to be settled, and the next best thing tried. Cab signals and Mr. Cade's audible roadside signal have well known drawbacks; but they involve no difficulty with brakes; and *if* automatic stops cannot be made satisfactory and

if the public is not going to be satisfied with our present system, it may become expedient to encourage some such device.

This, it seems to us, is the line of argument of the more level-headed of the automatic stop advocates; and these advocates are too numerous to be ignored. Congress and other public bodies blindly demand that the railroads do something. It is not fair to keep the public in the dark. It is not even consonant with enlightened self-interest to maintain a silence which is interpreted as indifference. Except as continued freedom from collisions may keep Congress in a somnolent condition, the fundamental issue still hangs over our heads.

Between the ideas of the advocates of stops, whose position we have here outlined, and those of the conservatives, recounted in our first article, there are some pretty radical differences, although at first thought it might seem that they differ only as to details. The opposing sides have never met each other in fair and free debate. But the importance of the parties, if not the importance of the subject, would seem to demand that this anomalous condition be brought to an end. This phase of the problem will be considered in a third article.

THE STOKER SITUATION

As to whether the mechanical stoker for locomotives is to be considered a success or not, in the present stage of its development, depends on the viewpoint of the person expressing the opinion. If the opinion is based purely on up-to-the-present performances insofar as coal consumption per unit of work done is concerned, the answer would probably be in the negative, for undoubtedly stoker-fired do burn more coal than hand-fired engines. But if the question is to be viewed from the standpoint of ability to maintain steam pressure, and of handling all the coal burned, then the stoker is a success. It was, however, remarked two years or more ago at the Master Mechanics' convention that it is, apparently, a comparatively simple matter to design a stoker that will maintain steam pressure under ordinary and even extraordinary working conditions.

It is, of course, of prime importance that an engine should be kept hot. That is the first task imposed upon the fireman, and for its accomplishment all other things must take second place, even to that of lookout for signals, because it would be a hazardous excuse to offer for a steam failure that the fire was neglected to call signals. Full steam pressure means relief to the engineer, as he can work his machine to its full capacity; he can make the time, and the despatcher knows that he can count on trains reaching meeting points at the estimated time. If to this we add a certainty as to steam pressure at all times, regardless of grade, loads, speed, length of run and weather conditions, we have eliminated many of the uncertainties of train operation and put confidence in the heart of the operating department. This can now be done by the stokers on the market. They can remove that factor, "the fatigue of the fireman," from consideration and give the despatcher confidence that a weary man at the end of a long division is not one to be reckoned with. It means that the engine can really be loaded to capacity without danger of steam failure and that it can be counted upon to work to its maximum efficiency to the end of the run. And, as a necessary consequence, its rating is increased. The engineer in this is relieved of the necessity of favoring his fireman. He can work the engine as he would like, regardless of the man. He is not called upon to trade water for steam, and lose time lest he lose pressure. In short, he can keep both eyes on the lookout instead of keeping one always on the steam gage. This the present stokers can accomplish.

If, then, the stoker burns more coal per engine mile or per ton mile, the question is, are not the results worth it? It is generally conceded by those railroad men who have been most successful in the use of stokers and have the largest number in service, that the engines so equipped do burn more coal than those that are hand-fired. But the comparison is apt to be made on the basis of the engine mile. Sometimes tonnage has been increased, but always operation has been improved, so that the actual increase of coal consumption is subject to a discount dependent upon the actual increase of tonnage and the value that may be put upon the improvement in operation. Hence the apparent extra fuel cost may be either entirely eliminated or, at least, greatly reduced, dependent on the modifying factors that may be used in making the calculation.

As for the extra fuel consumption, there is a very good reason for its present existence, but, apparently, none for its continued existence. As already stated, the first condition imposed on the fireman is that he should maintain his steam pressure. When he is firing by hand, and especially towards the end of a run, he favors his own back by using as little coal as he can, and so saves coal. With a stoker he has his eye on the steam gage, and takes no chances, and, as it requires no effort to put coal into the firebox, he makes sure that he is putting in enough, which means that he always puts in too much. But he holds the pressure. It is, then, a matter of the education of the fireman to train him so that he will put in enough and not too much coal, that he will watch his fire at all times, with even greater care than when hand firing, and that he will give the stoker operation his constant and unceasing attention. The work done by the locomotive on the road varies from minute to minute and almost from second to second, and if the best results are to be obtained with a stoker, its adjustments should follow each other with the same rapidity as the variations in the work done by the engine.

On general principles, there is no reason why a stoker-fired engine should burn more coal than one that is hand-fired, and many reasons why it should burn less. The firebox can be designed so as to secure the best conditions of combustion; the door need not be opened, and the air supply above and below the bed can be adjusted to secure the best results. But we still have the human element of indifference and carelessness to contend with, with every inducement towards an excessive fuel supply. How these can be overcome is a difficult problem. A fuel premium has been suggested as a proper and possible solution.

Based on the sentiments of the men using the stoker, it is a success. The men like it. After they have become accustomed to it, they have confidence in it and its labor-saving qualities recommend it. But it is new, and men have to be educated up to it. It frequently happens that a stoker will be a perfect failure on one run, and the men will declare it unfit for use, and then on the next run, without any work having been done on it, it will do a one hundred per cent. job of stoking with a different crew. In short, the personal equation is still an important factor in stoker operation.

Large engines with cylinders of 25 in. diameter or over can do a great deal of work if they are properly fired, but they must be supplied with large quantities of fuel and this means heavy labor for a man if the locomotive is to be worked to capacity. The man tires, the stoker does not. With the man, engine efficiency falls; with the stoker it can be maintained to the end of the division. The stoker does, and for some time probably will, burn more fuel than the man, but it is on the whole reliable. Its cost of maintenance is at present unknown, but will probably range from one-half to one cent a mile. The troubles which it will develop will probably increase with the number of stokers in use. It will require constant attention and supervision. It will add another element of care to be looked after by the mechanical department. But in spite of these added burdens, it looks very much to an outside observer as though its advantages outweighed its disadvantages, and that the time is not far distant when it will be considered an economical necessity.

NEW BOOKS

The Validity of Rate Regulations, State and Federal. By Robert P. Reeder, of the Philadelphia bar. 440 pages, 6 in. by 9 in. Bound in buckram. Published by T. & J. W. Johnson Company, 535 Chestnut street, Philadelphia.

This book is a treatise dealing with the principles of constitutional law which are involved in the various phases of rate regulation by the federal and state governments, and which are fundamental to an understanding of the many problems connected with rate regulation. Established principles are stated clearly, accompanied by many quotations from the decisions of the courts in the rate cases themselves, and many unsettled problems are discussed at length by going into a broader consideration of the purposes of those who placed in the federal constitution the provisions which bear upon rate regulation.

The treatment covers the contrast between state and federal power, the methods of making and enforcing regulations, the principles governing the valuation of property for rate-making purposes, the constitutional rate of return, discrimination in regulations, and the impairment of contracts. Especially valuable is the discussion on valuation of property and on the relation of the due process provision of the constitution to substantive law. The chapter headings are as follows: "The Commerce Clause," "The Distribution of Governmental Powers," "The Due Process Clauses—Position of Court," "Due Process Clause—Discussion," "Equal Protection Provision," "Just Compensation," "Impairment of Contracts," "Preferences to Ports," and "Limitations Upon Federal Judicial Power." The book contains four thousand citations, with parallel references.

Railroad Statistics. Published by Price, Waterhouse & Co., 54 William street, New York. 9 in. by 12 in. 70 pages.

This is a combination of statistics derived largely from the annual reports of the larger railroad companies to their stockholders, and in the case of rates conveying to their stockholders from December 31 of statistics reported to the Interstate Commerce Commission. Compiled by an accounting firm of international reputation, it may, of course, be relied upon for accuracy and some of the derived figures are unusually interesting and informing. The principal railroads of the country are divided among eight groups: eastern trunk lines, anthracite railroads, southern and southeastern lines, trunk lines west of Pittsburgh and Buffalo, middle west lines in the north, middle west trunk lines, mountain lines and Pacific lines. The figures cover from 1909 to 1913 inclusive. The units selected are used intelligently, for instance freight and passenger renewal is based on per mile of road operated, while rail renewals, tire renewals, etc., are based on mile of single track operated and maintenance of locomotives on the per locomotive per pound of tractive power per locomotive mile and per locomotive mile per thousand pounds of tractive power basis. The average figures for each group are given on an average for all groups.

List of Publications Pertaining to Government Ownership of Railways. Compiled by the Bureau of Railway Economics, Washington, D. C. 74 pages, 6 in. by 9 in. Bound in paper.

The Bureau of Railway Economics has compiled and issued a very comprehensive bibliography of the available literature on the subject of government ownership, whether good, bad or indifferent, or whether favorable to or against government ownership, which may be found in the principal libraries of the country. Sixty libraries are included in the list and all books and pamphlets listed are accompanied by key letters indicating in what library they may be found. The references are grouped under a general head and under the various countries, and in the case of the United States, under the separate states. There is also a separate list of authors. In view of the present keen interest in the subject of government ownership, this bibliography should be of great value to railway men and to all interested in the subject.

Letters to the Editor

THE POSITIVE MEET; FEWER ORDERS NEEDED

BOSTON, June 4, 1914.

TO THE EDITOR OF THE RAILWAY AGE GAZETTE:

I have been reading, in your issue of May 29, the letter of A. C. D., referring to the use on the New York, New Haven & Hartford of the positive meet, and maintaining, in effect, that in Oklahoma it would be impossible to carry out the practice which prevails on the New Haven.

I do not suppose that you care to give space in your columns to a controversy on this subject, and, indeed, I do not wish to waste time in contradicting; but A. C. D. has overlooked a few simple facts.

In the matter of operating lines where the telegraph offices are far apart, the New Haven is no better off than other roads. Sending out trains to turn around at some obscure industry track is as common here as elsewhere.

And the argument that men will make mistakes under one system the same as under another, which the writer repeats, has no force (or, rather, it is as favorable to the New Haven as to the other side) because, regardless of whether the men are well informed or ill informed, whether they have much knowledge or little knowledge, the simpler you make their train orders, and the smaller the number of orders issued, the less the liability to confusion and misunderstanding. With the positive meet, the despatchers issue a very much smaller number of orders.

Your correspondent also seems to have overlooked the fact that the despatchers who testify to the merits of the New Haven system have had experience under both systems.

NEW HAVEN.

TRANSVERSE FISSURES IN RAILS

NEW YORK, July 9, 1914.

TO THE EDITOR OF THE RAILWAY AGE GAZETTE:

The report of H. W. Belnap, general inspector of safety appliances, to the Interstate Commerce Commission, dated April 24, 1914, covering investigation of an accident which occurred on the New York, New Haven & Hartford near Westerly, R. I., on October 13, 1913, contains the general conclusion drawn by James E. Howard, engineer-physicist, that the cause of the so-called internal "transverse fissure" is the action of high wheel loads upon hard steel rail.

Owing to the publicity attending reports of this nature and the reliance which the general public may assume can be placed upon the findings of government investigators, it is well to enlarge somewhat upon this subject.

The subject of internal transverse fissures, although old (see article by Robert Job, *Railway Age Gazette*, February 6, 1914), has recently received renewed interest and investigation, principally because it has been brought into prominence by a report by Mr. Belnap to the Interstate Commerce Commission. In fact, it is being given undue prominence, since this type of failure, comparatively speaking, is of infrequent occurrence. This fact in itself is in contradiction to Mr. Howard's theory, for if fissures have been developed in normal rail by existing wheel loads, why have they not developed in adjacent rails of the same weight and manufacture which were laid at the same time and have necessarily carried the same tonnage? If Mr. Howard's theory were correct, the development of a fissure in any rail would roughly determine the service life of all rails of that or lighter weight laid at the same time or at any earlier date in track having like service, which, of course, is untenable.

Furthermore, all railroads with the same wheel loads and rails from any makers would show the same results as regards breaks due to transverse fissures.

As a matter of fact, under like operating conditions and the same rail specifications, some roads have had less trouble of this

character with all of their rails than have other roads and the output of some rail mills has proved better than that of other mills.

It appears that to date neither the rail experts of the railroads nor of the manufacturers have been able to definitely prove the primary cause of such fissures, although much progress has been made within the last few months, and all the evidence so far produced appears to indicate as the cause defective material in the rail.

It has been discovered that the so-called "transverse fissures" may be longitudinal, horizontal or inclined in any direction to the axis of the rail; they have been discovered in rail in which the carbon percentage is moderate and below the upper limit of the standard specifications for the section involved; there is no evidence of segregation in these rails; in no case reported have two or more adjacent rails shown transverse fissures, and several fissures have been found in a single rail.

It is true that this type of break is disclosed by traffic, as is every other form of break. It is also true that the lighter the traffic the less frequently are these and other rail breaks apt to occur. An unsound rail, no matter what may be its type of unsoundness, should and does give way under a load well within the limits of the carrying capacity of sound rails and a rail suffering from the deep-seated disease under discussion is no exception to this general rule.

It is to be hoped that the real cause of transverse fissures may be brought to light, but until such is the case it is not just to attribute such failures to assumed imprudent practices of the railroads. Such an attitude constitutes an illogical and unwarranted attempt to make capital by following the popular practice of ascribing all faults, without proof, to the railroads.

ENGINEER.

POOR OPERATORS AND THE TROUBLES OF THE DESPATCHER

HAILEYVILLE, Okla., June 26, 1914.

TO THE EDITOR OF THE RAILWAY AGE GAZETTE:

The paper on the training of telegraph operators, by Mr. Sheldon, of the Union Pacific, which was printed in the *Railway Age Gazette* of May 29, will be read with much interest by a great many railroad officers and employees.

Mr. Sheldon's somewhat optimistic views will lead many a despatcher to ask numerous questions. Looking at the subject broadly, and taking in the whole western country, the question frequently recurs whether there cannot be something done to improve the quality of the operators now entering the service on nearly all of the principal roads. It may be that, as Mr. Sheldon says, three or four months in a training school, with a few more months of training under some agent out on the road, will make an operator; but what is the percentage of failures?

The advent of the telephone has made a radical change in the problem of the education of operators. Many officers carelessly assume that anyone can operate the telephone. But as long as we use the telegraph, whether for long distance work or for anything, we need competent telegraphers. It requires just as much proficiency to operate the wire now as 20 years ago. It requires more, for the reason that we are working faster than at that time. It is too readily assumed that as soon as a man can receive 15 or 20 words a minute he is an operator. What about his sending? Has anyone ever passed on that? Is it not just as important, or more so, that he send well? The copying operator makes fewer mistakes with good sending than with bad. How many officers think of that feature?

As a general rule, the young operator, as soon as he secures a position, buys what they call a "bug"; and in the novice's opinion the proposition is solved. But it requires several weeks to learn how to operate the thing, and, in fact, some never learn; and during this time he works an imposition on everyone else, in trying to use the bug. This, with his other shortcomings, helps to make life a burden for all who deal with the new operator. A railroad company should not allow such instruments to be used. A good sender with his hand can send as fast as the average operator can put it down in good shape. Good hand senders are scarce. Add to this a half dozen beginners trying to handle their bugs and the despatcher certainly has his troubles.

Again, the average chief despatcher, who generally employs the operators, does not examine them on their sending or their receiving, or on wire testing. He gives the operator a note to the examining physician and if he passes the physical examination this seems about all that is necessary. He goes out on the road and is charged with the serious duty of handling train orders and the other business of the company. Then who has to worry with him? No one but the despatcher, who has his hands full already. Yet he is expected to make a good showing in expediting the movement of trains, with poor men as well as with good. Students are sometimes sent to a heavy train order position. Human lives are intrusted to these men. If the despatcher complains, he is put down as a kicker and a crank. The operator thinks he is abused if the despatcher loses his patience and criticizes him, but who wouldn't lose it? Some of the timber sent out on the line will justify any amount of anger.

The young operator, just setting out, usually can tell more about the operators' pay schedule than he can about the block or train order rules. If he works the meal hour or thirty minutes over his time, an overtime slip is sent in, and is referred to the trick despatcher by the chief with a big "Why" in box-car letters. The student does not take into consideration that possibly you have let him off for a couple of hours a few nights before. And this is just as true of the old head as with the new. What would some of the operators of the present day have done 20 years ago when 12 hours was a day's work and no overtime, no lunch hour? In addition to this operators made themselves generally useful around the station as clerks to the agent and the section foreman, in the way of doing clerical work and handling the switch lamps. Nowadays, if an operator handles switch lamps, he gets paid for it, and it is a hard matter to get him to do the least bit of station work, to say nothing of sweeping out the office. In those days we received from 30 to 40 dollars a month; now it is a minimum of from 55 to 60 and overtime every time they turn around; and a nine-hour day.

Operators receive more solid training from the train despatcher in one week than from any other employee in a month. It is often noticeable that the despatcher will worry along with an operator for months trying to educate him up to the standard, thinking he will eventually make a good man. But in a large proportion of cases he fails, and all the time he is handicapping himself.

I have many times, in case of students, asked conductors to come to the telephone and get their orders on account of the operator being too slow; yet the operators are complaining today because the railroads are putting in emergency 'phones to facilitate business. Why shouldn't the 'phones be put in? The time is fast coming when if the telephone fails business operations will cease at some stations simply because the operators are not competent to operate the telegraph wire.

With the high salaries now paid there is no reason why we should not have a better class of operators. If schools are necessary to secure the right men, let us have them. As long as no more attention is given to the qualification of operators when hired than is usual at present, we shall continue to have poor service. With the increased responsibilities and increased territory the despatcher does not find much time to educate operators to enable them to hold their jobs. It is about all the despatcher can do to hold his own.

J. L. COSS.

SIMPLON TUNNEL BETWEEN ITALY AND SWITZERLAND FLOODED.—The Simplon tunnel was inundated on July 7 by a subterranean stream which burst through the retaining wall and flooded the tunnel to a depth of two feet. A train was derailed in the middle of the tunnel, but no one was hurt. The passengers, however, were obliged to walk several miles to Iselle. Trains had to be diverted via the St. Gothard route.

Results of the Electrification of a Congested Italian Line

A Line with Very Heavy Grades and Long Tunnels on Which the Capacity Was Increased 100 Per Cent

By L. Pontecorvo

One important economic reason which determines the electrification of a steam line is the necessity of increasing its capacity. Results of electrification brought about by conditions of congestion are, however, quite unknown, as nothing has been published in connection with such cases. An examination of all single phase trunk lines with heavy freight and passenger service shows no case where the electrification was determined by the necessity of increasing the capacity of the line.

All the tri-phase installations of the Italian State Railways,

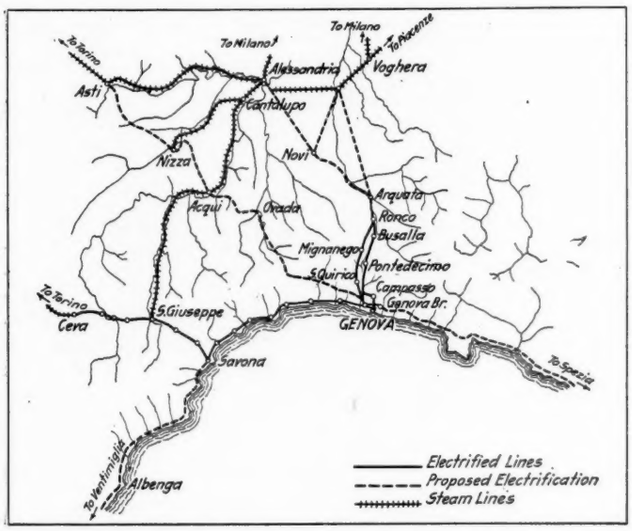


Fig. 1—Map of the Railway Lines Radiating from Genoa

with the exception of the Valtellina lines electrified 12 years ago for experimental purposes, were determined by the necessity of increasing the capacity of the line, and to this was certainly due the choice of the system, the Italian State Railways having found the three-phase system the most suitable for increasing the capacity of trunk lines with very heavy grades. We will, therefore, describe the actual results obtained on a line presenting the most difficult service conditions, and where the steam service had exhausted all its resources and could not be improved on.

The line referred to, the Giovi line in Italy, can be considered completely regenerated by the three-phase traction, having acquired, as regards freight service, which is the most important on that line, the same, if not a greater, capacity than the parallel line, the so-called "Giovi Subsidiary Line," which has grades half as steep and the most up to date block system.

To make these results better understood the electric railway system in Italy and its development, particularly as regards the Giovi line, which is one of the oldest trunk lines in Italy, will be briefly described.

ITALIAN ELECTRIC RAILWAY SYSTEM

The Italian State Railways has a large number of electric lines which are situated in that part of Italy, where most of the industries are located, as shown in Fig. 1. Table A gives their most important characteristics.

The Milan-Porto Ceresio line, the first built, has a direct current of 600 volts, and the electric service is limited to passenger trains. All the others are three-phase 3,000-3,300 volts 15-16⅔ periods, with electric service both for passenger and freight trains. These railway lines are equipped with same system of traction, and are operated by the same type of locomotives, and constitute the most complete example of railway electrification in Europe.

The Valtellina line was electrified in 1902 for experimental purposes only. However, it has derived many advantages by the electrification, and has shown itself more economical than the steam service. In 1897 the operating expenses per axle with steam service were Lire .129 = (2.5 cents), and in 1902-3 with electric service were Lire .114 = (2.21 cents); that is, a reduction of 12 per cent., including interest and depreciation on the investment.

Of the other lines, the old Giovi line (double track) was electrified in 1910 to increase its capacity, and as were the Bassaleno-Modane line (partly single and partly double track) electrified in 1912-1914, and the Savona-San Giuseppe single track line. The electrification of the Monza-Lecco line was due to various reasons, chiefly the advantage of improving the service on a line which connects an important city like Milan with one of the most attractive valleys of the Alps.

THE TRAFFIC OF THE GIOVI LINE.

Considering now the Giovi line, and especially the Section Pontedecimo-Busalla, which offers the greatest difficulty to the operation. The tonnage in and out of the harbor of Genoa,

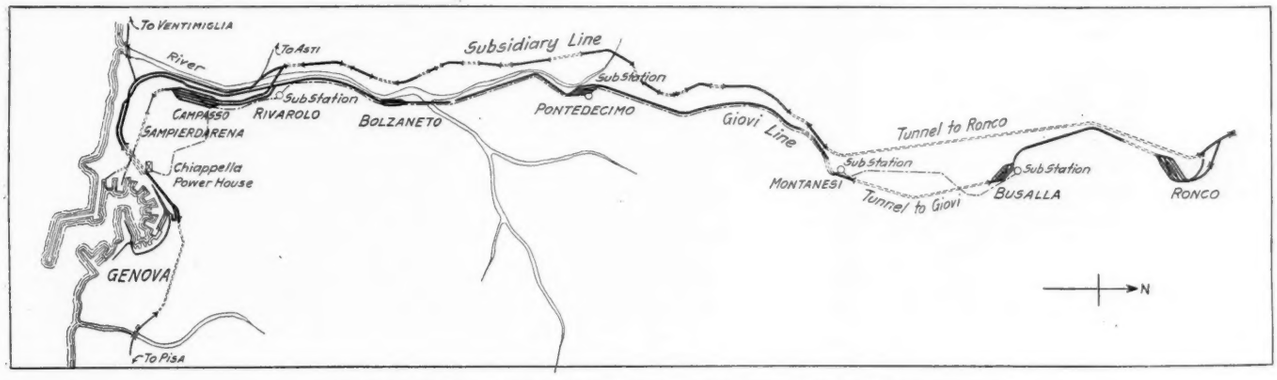


Fig. 2—Map Showing the Giovi Three-Phase Electric Lines

which in 1878 amounted to less than a million tons a year, has been increasing rapidly, reaching 7,368,000 tons in 1912, of which 84 per cent. represents import and 14 per cent. export business.

There are five railway lines leading to Genoa which handle this traffic. The two Giovi lines, which constitute the direct connections between Genoa and the greatest manufacturing provinces of Italy—Piedmont and Lombardy—handle the most

TABLE A—LINES ELECTRIFIED (*a*)

Lines	Year	Length of the line in miles single track	Maximum grade, per cent.	Line voltage	Current and frequency	Number of substations	Total capacity of substations in kws. or kva.	Voltage of primary trans. line	Capacity of power house in h. p.	Energy produced at central station during 1912-1913, million "kw." hour	Number of locomotives	Miles run during 1912-13	Capacity of locomotives, h. p.
1—Milano-Varese	1901	70.2	1	650	Direct current	7	14,000, of which(3) 7,000 as standby	45,000	20,000, of which 5,000 as standby	8.5	47(14)	1,380,000(11)	18,200
2—Lecco-Sondrio-Chiavenna (Valtellina)	1902	65.8	2	3,000	A.C. 15 cycles	11(1)	5,360, of which(4) 1,480 as standby	20,000	6,000, of which 2,000 as standby	5.7	24(14)	514,000	22,600
3—Giovi	1910-13	28.8	3.5	3,000	A.C. 15 cycles	4	12,000, of which 3,000 as standby	13,000	12,000, of which 6,000 as standby	9.0(8)	24	380,000(8)	48,000
4—Bussoleno-Bardonecchia..	1912	35.8	3	3,300	A.C. 16⅔ cycles	5(5)	18,500, of which 8,000 as standby	50,000	6,800 (6)	4.1(9)	16	165,000(9)	32,000
5—Savona-Ceva	1914	28.3	2.5	3,700	A.C. 16⅔ cycles	5	15,000, of which 3,700 as standby	56,000	..... (7)	...	24	.....	48,000
6—Monza-Lecco (15)	1914	27.4	1.2	3,400	A.C. 15.8 cycles	4	15,750, of which 6,750 as standby	20,000	..... (12)	...	13(10)	.....	29,000(10)
7—Bardonecchia-Modane (15)	1914	23.6	3	3,300	A.C. 16⅔ cycles	0(2)	0 (2)	56,000	..... (2)	...	8(10)	.....	16,000(10)

(*a*) This table does not contain the Simplon three-phase line, as it is operated by the Swiss Federal Railway, although it runs for half of its length in Italian territory.
(1) To this number must be added a portable substation used as reserve.
(2) This line will be supplied by feeder from a substation of line No. 4.
(3) To these figures should be added 2 flywheel sets used to take care of the pick loads.
(4) These figures include the portable substation.
(5) At present the current on this line is supplied from a 50,000 volt, 50 cycles line and transformed. This is only a temporary arrangement.
(6) As above.
(7) Energy is supplied by power house of Negry Company, which reserves for this service 10,000 kw. with picks of 15,000.
(8) The electric service on the whole line was started only in October, 1913.
(9) These figures are for the period July-October, 1913.
(10) Estimated figures, as service is not started yet.
(11) Includes a branch line, Varese-Porto Ceresio.
(12) These substations are so equipped as to allow lines 2 and 6 to be connected and supplied with energy from either of the two power houses.
(13) Energy is supplied from power house of Edison Company, which reserves for this service 4,000 kw. with picks of 5,000 kw.
(14) Some of these are passenger motor-cars capable of hauling several passenger cars.
(15) On these lines the electric service will be started shortly.

of the freight traffic, approximately 80 per cent.; the Genoa-Spezia handles 8 per cent., the Genoa-Asti 7 per cent., and the Genoa-Ventimiglia the remaining 5 per cent. While the Genoa-Asti connects Genoa to the Piedmont it has a very limited service due to heavy grades, single track and poorly ventilated tunnels. At present the electrification of this line is under consideration.

The old Giovi line, opened to service in 1853, was proposed and built by the famous statesman Cavour, who early foresaw the importance of the harbor of Genoa in the industrial development of Italy. It is a mountain road which rises from the sea level, crosses the Apennines, and descends in the valley of the river Po. It has maximum grades of 3.5 per cent., six tunnels, of which the longest, the Giovi tunnel, is 2.02 miles. These conditions make the operation with heavy and long freight trains most difficult. The line has a total length of 14.4 miles, and a difference in level of 1,150 feet between the lowest and the highest station. On account of the great difficulty of operation with steam locomotives, and in consideration of the continuous growth of the traffic in the harbor of Genoa, the Giovi Subsidiary line (double track) was built in 1889. It branches off the old Giovi line, and runs parallel to it on the other side of the valley, and crosses the mountain pass under a tunnel 5.15 miles long, and then joins the old line. It serves the same purpose as the old line, but offers considerably better service conditions, having uniform grades not exceeding 1.6 per cent., and reaching 1.16 per cent. in the longest tunnel. The total length from where it branches off is 13.7 miles, and the highest point is 1,060 feet above sea level.

In 1906-7 the maximum quantity of freight accumulating on the docks at Genoa amounted to 575,000 tons, and the average between October and January was 450,000 tons. To improve conditions, at the end of 1907, a new type of steam locomotive (Fig. 5), designed particularly for this service by the Italian State Railways, was put in service, producing a considerable improvement. These locomotives were of the compound 4-cylinder type, and had the following characteristics:

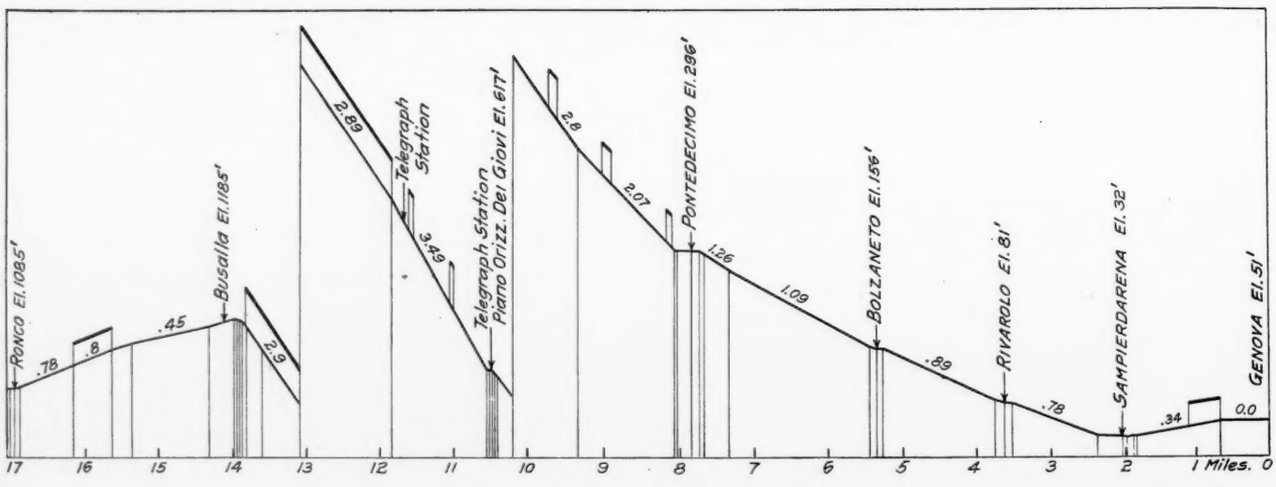


Fig. 3—The Profile of the Giovi Line

Number of coupled axles	5
Weight in working order	75 tons
Weight of tender, loaded	28 tons
Total heating surface	2,060 sq. ft.
Working pressure	229 lb. per sq. in.
Diam. of high pressure cylinders	14.7 in.
Diam. of low pressure cylinders	24 in.
Length of stroke	25.6 in.
Diam. of driving wheels (when new)	53 in.

During the official tests carried out by the Italian State Railways the following results were obtained.

(1) When hauling a train of 204 tons (exclusive of locomotive)

Speed on 2.5 per cent. grade.....25 miles an hour
Drawbar pull on 2.5 per cent. grade.....12,200 to 13,400 lb.
Indicated horsepower 1,200
Drawbar horsepower 800

(2) When handling a train of 272 tons (exclusive of locomotive)

Speed on 2.5 per cent. grade.....15.5 miles per hour
Drawbar pull on 2.5 per cent. grade.....16,600 lb.
Indicated horsepower 900
Drawbar horsepower 650

These new locomotives on the old Giovi line could haul the following loads at a speed of 15.5 miles per hour:

Single locomotive .....170 tons
Double locomotive .....310 tons
Triple locomotive .....450 tons

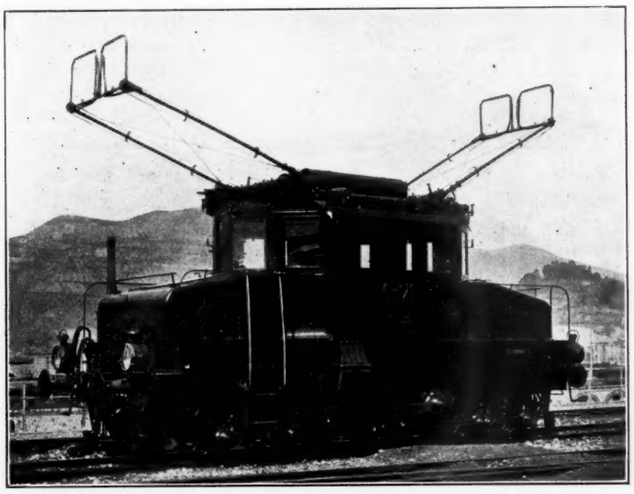


Fig. 4—Westinghouse Electric Locomotive (Type F. S. 050) Now Used on Italian Giovi Line

By the use of these more powerful locomotives it was possible in 1907-8 to reduce the quantity of goods accumulating on the docks at Genoa to a maximum of 430,000 tons, and to an average of 350,000 tons during the months from October to January. However, this improvement did not last long owing to the continuous increase in tonnage, and in 1909-10 the quantity of goods on the docks reached maximum and average amounts, respectively, of 545,000 and 484,000 tons. This condition, of course, represented an enormous loss due to the delay caused to trade in general, and the damage and deterioration of perishable freight.

ELECTRIFICATION OF GIOVI LINE

This state of affairs and the conclusions arrived at by the committee appointed by the government led to the decision of building another subsidiary line to take care of the natural and continuous growth of one of the most important harbors of Italy. This new line, called "the direct line," was to be a double track line with low grades, and cross the Apennines through a tunnel 11.8 miles long. The estimated cost was $30,000,000, and the necessary appropriation was voted by congress. However, the above mentioned committee in its report to the government, in consideration of the fact that the building of this new direct line with such a long tunnel would require many years, and having in mind the successful experiments of double traction carried out on the Valtellina and Simplon electric lines, suggested besides other improvements the electrification of the old Giovi line as the means of increasing its capacity.

In consequence of the satisfactory results obtained on the Simplon and Valtellina lines the three-phase, 15-cycle system was chosen for this electrification. It was also decided to increase the speed of the trains on this line to 28 miles per hour on the up grade, and to increase the power of the locomotives to the maximum amount allowed by the type of rolling stock.

Westinghouse locomotives (type F. S. 050), having two running speeds of 14 and 28 miles per hour, were chosen for the service. These locomotives (Fig. 4) were designed by Mr. de Kando, and built by the Italian Westinghouse Company at Vado Ligure, Italy. They are equipped with two slip ring induction motors, 3,000 volts. Their characteristics are as follows:

Number of coupled axles.....5
Adhesive weight of locomotive.....60 tons
Diameter of wheels (when new).....42.5 in.

The motors are connected to the wheels by a special triangular yoke.

With trains of standard composition (which is the maximum allowed by the draft gear of the cars, but which can be increased as far as the locomotives are concerned as shown by tests), when running at 28 miles an hour, the maximum horsepower developed is 1,770. When starting on a grade of 3.5 per cent., hauling the same train, there is developed 2,180 horsepower. The capacity of the locomotives on the Giovi line was fixed as follows:

Single locomotive ..... 190 tons
Two locomotives ..... 380 tons
Three locomotives ..... 530 tons

The electric service was started in 1910.

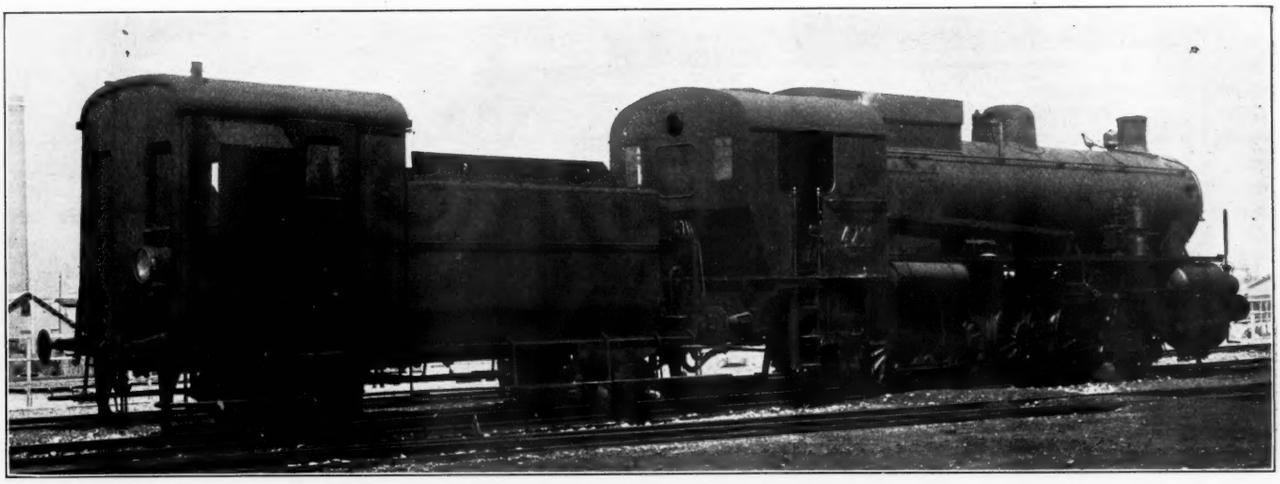


Fig. 5—Steam Locomotive Formerly Used on the Giovi Line

SERVICE RESULTS OF ELECTRIFICATION

The increased capacity of the line is, of course, due to the greater power of the electric locomotives and the increase in speed. The peculiar condition of the line allows us to verify the calculated increase in the capacity of the line after the electrification. The steam locomotives had a maximum running speed of 15.5 miles per hour on the steepest grades. The electric locomotive runs at 28 miles per hour on the 3.5 per cent. grades.

Similarly on the down grades, owing to the electric braking, and to the constant speed and absence of shocks, it is possible to allow a speed of 28 miles per hour for passenger trains where the maximum speed allowed for the same trains with the steam service was 18.6 miles per hour. In addition with the steam trains a safety stop of all trains was made on a level section of the line about half way down the grade. This compulsory stop has now been done away with.

If we take into consideration the commercial speed of the trains on this section of the line it represents an increase of 88 per cent. and 75.5 per cent. on the up and down grades, partly due to the shorter time taken by the electric locomotive for acceleration. This increase is clearly shown by the time tables (Figs. 7 and 8) of the steam service on its last year 1910, and of the electric service now in operation.

With the steam service it was possible to run a maximum of 28 up trains and 23 down trains per day, spread over a period of 20 hours. However, the average number of trains per day was considerably lower. In the last year of the steam service, 1909-10, a total of 8,793 up and 7,792 down trains were run, or

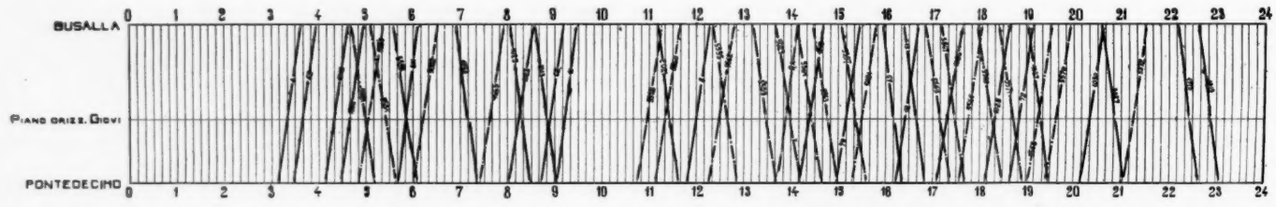


Fig. 6—Schedule of Steam Service in Summer of 1910

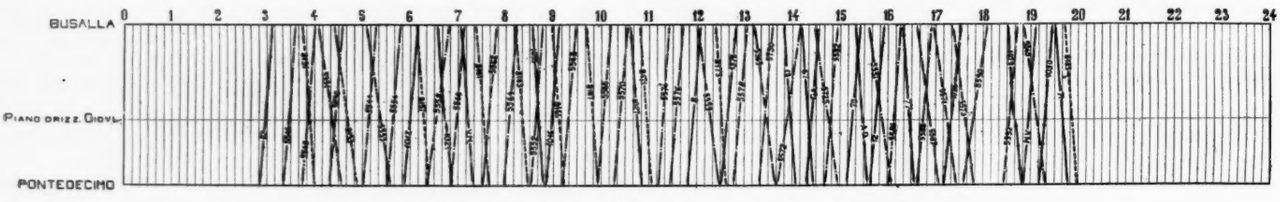


Fig. 7—Schedule of Electric Service in 1914

Extra fare trains.
Express trains.
Local trains.
Freight trains.

an average of 24 up and 21.3 down trains per day. With the electric service there were run in 1911-12 12,024 up and 8,050 down trains, or an average of 33 and 22, an increase of 37.5 per cent. in the number of up trains, constituting the increase in the capacity of the line. It was not necessary to increase the number of the down trains, the greater number of cars being empty on the down trip.

With operation by steam the above figures were not susceptible of appreciable increase, both because of the limited speed of the locomotive and the difficult work of ventilating the Giovi tunnel; the steam service shown in the schedule in Fig. 7 was only possible by strong artificial ventilation of the tunnel by means of a special blower driven by a 500 horsepower motor.

With the electric service the average figures given above refer to a schedule spread over a period of 17 hours per day (Fig. 8), and therefore they could be increased considerably. For instance, during the month of April, 1913, on the same section of the line referred to, 223 trains were run in addition to those shown in the schedule, corresponding to an average of 7.45 trains per day, of which 5.2 were up and 2.25 down trains. The maximum number of additional trains per day during the same month of April, besides the trains shown in the schedule, was 13, of which nine were up and four were down trains. Therefore, the average and maximum values for the month of April would be 38 and 42 respectively, which compared to the 28 of the steam service represents an increase of 36 and 50 per cent.; and if we consider that the electric service is limited to 17 hours instead of 20, the increase would amount to 61 and 77 per cent. The same results were obtained during certain days in the month of August when numerous extra trains were run for the purpose of testing the new electric locomotives.

These figures do not represent the maximum obtainable by the electric service. This maximum was determined when the project of electrification was being considered, and all the fixed installations, such as the central station, sub-stations and transmission lines were designed for a service having trains starting every 10 and 15 minutes. Such service, as has been shown experimentally, is possible both because of the size of the electric installations, and because of the block system existing on the line, as the time taken to cover the length of the tunnel is 9 minutes, and therefore with a train starting every ten minutes one train would leave the station at the entrance of the tunnel when the preceding had reached the telegraph station at the other end.

Assuming the utilization coefficient* of the Italian State Railways as .70, and assuming 20 working hours per day, as was the case with the steam service, the average number of daily trains with electric service would be:

Trains leaving every 15 min., .7 x 20 x 4 = 56
Trains leaving every 10 min., .7 x 20 x 6 = 84

These figures, as compared with 28 of the steam service, represent an increase of 100 and 200 per cent. respectively.

ELECTRIC LOCOMOTIVES

On account of the higher speed of the electric locomotives and their suitability for switching operations in the yard, it was possible with electric operation to make a rather large reduction in the number of locomotives, and therefore in the train crews. At present the service on this section is handled by ten locomotives of which eight are in actual service, one is held in reserve and one is under inspection. During 1909-1910 with steam service the average number of steam locomotives was 15. If we consider that with the electric service there are 34 trains to 28 with steam service, the number of steam locomotives was 82 per cent. greater than the number of electric locomotives. The daily service of the electric locomotive could easily be increased by increasing the working hours to 24, because the maximum temperature of the Westinghouse electric motors was only 73 deg. after 16 up and 16 down trips, hauling the normal weight of train and regenerating energy on the down trip, the last two trips having been made without forced ventilation of the motors.

TRACTIVE EFFORT AND COMPOSITION OF TRAINS

A comparison between the maximum weight of train permissible with the steam locomotive and the standard weight

*Utilization coefficient is the ratio between the average daily number of trains actually run and the number of trains given in the schedule.

of train prescribed for the electric locomotives, as allowed by the existing type of rolling stock, shows how much more powerful the electric locomotives are.

TABLE B

	Weight of train (exclusive of locomotive)	
	Steam traction	Electric traction
Single locomotive	170 tons	190 tons
Double locomotive (one locomotive pulling and one pushing)	310 tons	380 tons
Triple locomotive (one locomotive pulling and two pushing)	450 tons	530 tons

Considering that with electric traction an overload of 10 tons is permissible, there is an increase over steam operation of 17½, 26 and 20 per cent. respectively. However, as has already been pointed out, the tractive effort and the motor capacity of the locomotive are far greater, so that it is possible with two locomotives to haul on the same section of the line without any difficulty trains up to 450 tons at 28 miles per hour. As compared with the operation by steam, this means an increase in the drawbar pull of 45 per cent. without considering that the adhesive weight of the steam locomotives is 25 per cent. greater than the electric.

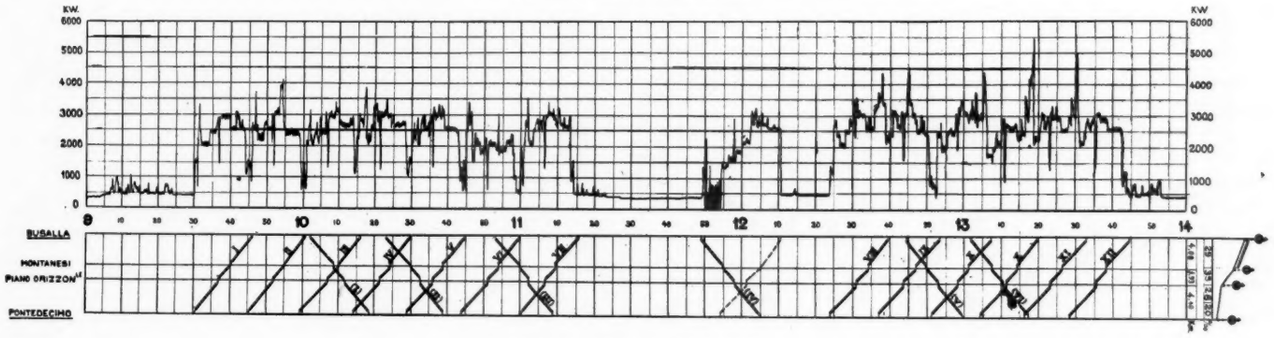
The make-up of the passeger trains on this line is not uniform, and varies from 200 to 370 tons. With operation by steam passenger trains left Genoa station hauled by one three-coupled locomotive. When this section of the line was reached two additional five-coupled locomotives were added, one pulling and one pushing. Very light trains were hauled by only two locomotives. With electric operation all passenger trains are hauled by two locomotives.

The freight trains were nearly all hauled by three locomotives, one pulling and two pushing. With electric service the freight trains have a uniform composition of 380 tons (being mostly freight cars of the same type loaded with coal), and are hauled by two locomotives, one pushing and one pulling. In the case of freight trains, if but one locomotive is used, it must be placed at the rear of an ascending or the front of a descending train, as the cars have no air brakes. If we refer to the last table, and consider that the Westinghouse electric locomotive, type 050, weighs 60 tons, while the steam locomotive 92 deg. 470 weighs (including the tender two-thirds loaded with water and coal) 97 tons, we find that the steam locomotive represents 57 per cent., 62.7 per cent. and 64 per cent. respectively of the hauled weight, while the electric locomotive represents only 30, 30.8 and 33.5 per cent. As compared to the total weight of the trains, the weight of the steam locomotive represents 36.3, 38.5 and 39.3, while the weight of the electric locomotive represents only 23.1, 23.5 and 25 per cent.

NUMBER OF CARS

From the preceding it follows that the number of cars delivered over the line after the electrification has been greatly increased. During the last year of the steam traction there was a total traffic of 109,963 cars (passenger and freight) on the up grade and 133,000 in the other direction. In 1911-12 after the electrification the number increased to 172,063 and 146,113, an increase of 56.5 and 10 per cent., respectively, without considering that the weight of the freight cars was also increased. And if we consider only the movement of the freight cars in the ascending direction there was an increase in their number of 109 per cent. This would correspond to a daily service of 165 cars (steam traction) and 346 (electric traction). If we refer, however, to the electric service as developed experimentally during the month of August, 1913, for 17 hours daily, it represents an increase of 218 and 214 per cent. This, however, does not represent the maximum of the electric service.

TRAINS EVERY 15 MINUTES.



TRAINS EVERY 10 MINUTES.

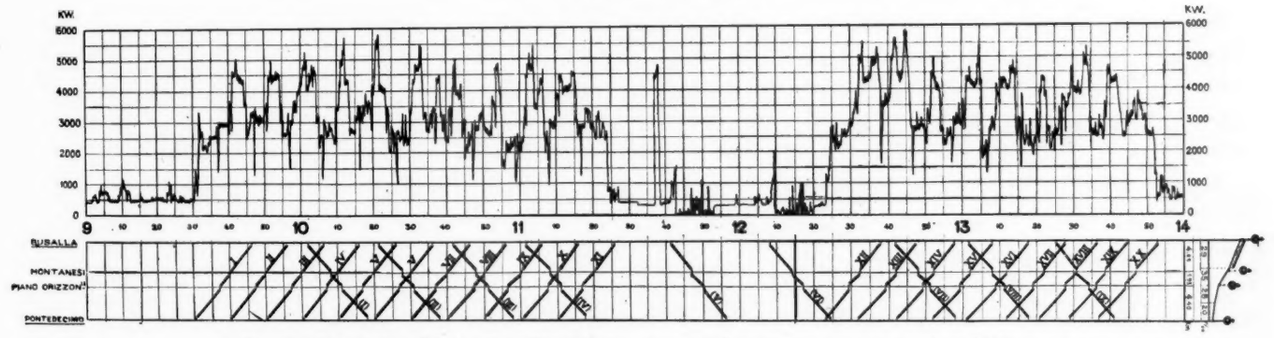


Fig. 8—Schedule of Intensive Electric Service and Load Diagram at Central Station

CAPACITY OF THE LINE

We can now determine the capacity of the Giovi line after the electrification and compare it to that before. For the steam service we will refer to the service in the year 1909-10, the last of the steam traction, and to the maximum capacity as estimated by the above-mentioned government committee. For the results of the electrification we will refer to the first year of the service, 1911-12, to the service as tried experimentally during August, 1913, and to the maximum permissible service as estimated by the Italian State Railways.

We will consider only the traffic on the up grade, which is the one that determines the capacity of the line, and limit it to 20 working hours per day, although it should be understood that

with the electric traction this limitation to 20 hours is not requisite. It was necessary with steam traction to allow time for maintenance of the tracks in the tunnel, as on account of the smoke the men could not work in it during the service hours. Besides, we will consider only the hauled weight of trains, which is the most important.

Electric Service 1911-12.—As already stated, the total number of cars was 172,063, divided as follows:

45,927 passenger and baggage cars.
105,132 freight cars.
16,897 fast freight cars.
4,107 empty cars.

The weight of these cars can be assumed as follows:

Passenger and baggage cars	30 tons
Freight cars, mostly coal cars	21 tons
Fast freight cars	12 tons
Empty cars	8 tons

The total capacity then is:

Passenger and baggage cars	1,380,000 tons
Freight cars	2,210,000 tons
Fast freight cars	203,000 tons
Empty cars	32,800 tons
Total	3,825,000 tons

Electric Service as Experimented with in August, 1913.—The experiments carried out gave the following figures:

41 trains	13,640 tons	644 cars	17 hour service
40 trains	13,712 tons	636 cars	17 hour service

These figures reduced to a year give 5,000,000 tons for 17 hours' service per day.

Now, assuming the same weight of cars (which is in favor of the steam traction because the weight of the cars has been increased during the last few years), we find the following figures:

Steam traction—20 hours per day.

38,916 freight cars	840,000 tons
19,569 fast freight cars	235,000 tons
49,624 passenger and baggage cars	1,485,000 tons
1,854 empty cars	14,800 tons
Total	2,574,800 tons

Comparing this figure to that of the electric service reduced to 20 hours per day, we find that the service during the year 1911-12 represents an increase of 75 per cent., and the service, as experimented with during the month of August, 1913, an increase of 128 per cent.

In comparing this service with the steam service we will assume the maximum capacity of the steam service, as outlined by the government committee, and will consider double locomotive service throughout. With the 15-minute service during 20 hours, we would have 80 trains per day, of which 15 are passenger and 65 are freight. Assuming a utilization coefficient of .70, we have 65 x .7 x 380, or 17,300 tons daily, or 6,310,000 tons yearly. With service every 10 minutes, we would have 120 trains, of which the 105 freight trains equal 10,200,000 tons yearly.

The maximum steam service would amount to 22 trains of 310 tons, or 6,820 tons daily, or 2,490,000 tons yearly. Therefore, assuming that the passenger trains are the same in both cases, we have an increase in capacity of 153 per cent. with 15-minute service, and 310 per cent. with 10-minute service.

It will take many years before the traffic of the harbor of

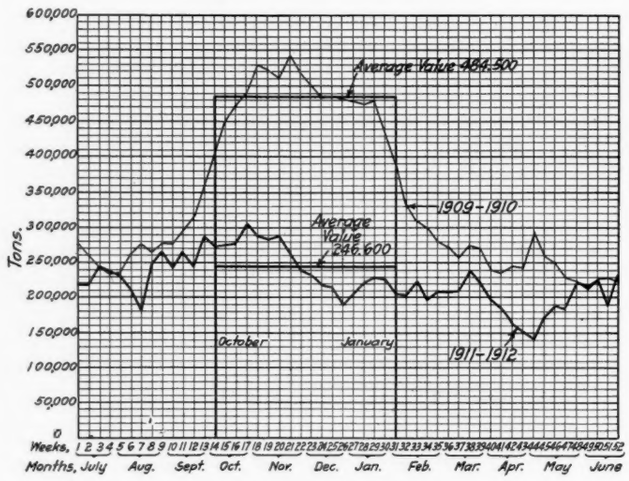


Fig. 9—Weekly Accumulations of Freight on the Docks at Genoa Awaiting Shipment by Rail

Genoa will be such as to require the maximum capacity of the Giovi line. Considering that on account of these results the Italian State Railways have electrified the subsidiary Giovi line and are considering the electrification of the Genoa-Asti line, it will be many years before the new "direct line" will be built.

The effect of the increase in capacity of the Giovi line on the quantity of freight accumulated in the docks may be easily seen from the diagram showing the freight accumulated on the docks

Fig. 10—Coal on the Docks at Genoa Awaiting Shipment

waiting shipment by rail. This compares the year 1909-10 (the last of the steam service) with the year 1911-12 (the first of the electric service). From this diagram we see that the maximum quantity of accumulated freight reached 540,000 tons in 1909 and 300,000 tons in 1911. If we consider the worst period of the year, October to January, the average quantity of the accumulated goods was 484,500 and 246,600; that is, a maximum of 80 per cent. and an average of 96.5 per cent. more freight accumulated during the steam service.

This shows that the electrification, besides solving a railway problem, increasing the capacity of a line so as to take care of the growth of the traffic for many years to come, has solved at the same time a serious problem of the excessive accumulation of freight at the docks during a part of the year; which accumulation caused great inconvenience and considerable loss. Thus the electrification has produced an increase in the capacity of the Giovi line and indirectly an increase in the capacity of the harbor of Genoa and very likely may do away with the building of the direct line with the tunnel which was estimated to cost not less than $30,000,000.

CONCLUSIONS

The Giovi line has been regenerated by three-phase operation. The line was of such importance to the traffic that the electrification was decided to improve existing conditions, even if that would mean an increase in operating expenses. However, the results from an economic point of view have been far better than expected, and constitute a very great success for the Italian State Railways. A detailed and careful examination made by the administration of the Italian State Railways has shown that the running expenses, including interest and depreciation on the investment, have been reduced 22.5 per cent., notwithstanding the fact that the electric energy is produced by a steam electric plant and that the central station capacity is not yet fully used. It has been realized in this electrification as Galileo Ferraris stated in 1904, in his speech on the transmission of electric energy, that electrification would render operation most economical in those cases where operation by steam was most expensive.

It is not our intention here to discuss the various systems of traction, especially as the Italian State Railways are satisfied with the three-phase system, and intend to extend it to all their lines as conditions require it. Having already in service 135 electric locomotives, of which 110 are of the Giovi type with a total capacity of 261,200 h. p., they are considering the electrification of new lines, not on theoretical calculations, but from actual results.

On account of the large increase in the capacity of the lines through the three-phase electrification, the Italian State Railways will be able to do away with double tracking single track lines where the traffic is getting too heavy and where the expenditure of double tracking is very high; besides, on account of smoke elimination, they will be able to greatly improve the service on lines with many tunnels, and most of the Italian lines are of that sort. There will also be the advantage of reduction in the running expenses, and by utilizing to a larger extent the hydraulic power not yet developed, importation of coal, which represents a heavy expenditure, may be reduced. But, if in this particular case there is no reason for a discussion of the systems of operation, we will, however, express the conviction that, although the results of the increase in the capacity of the Giovi line are due to electrification, it is also due to the choice of the three-phase system that the results were so striking. We do not mean to refer to the large savings due to characteristics of this system, such as the lightness of the locomotive and the regeneration of power, but to the characteristic of maintaining high speeds on the up grade with high tractive effort and high efficiency, which characteristic determines the capacity of the lines.

It is true that the section of the line referred to is specially suited for three-phase traction, but the electrification of the other sections of the line, which are nearly level and which are served by the same locomotives, has shown (as in the Valtellina lines) that the advantages of a light and powerful locomotive having few and fixed speeds can be felt even on level lines where the traffic is heavy enough to warrant electrification.

CHANGES IN BOILER INSPECTION RULES

The recommended changes and additions in the Boiler Inspection Rules, as published in the *Railway Age Gazette* of May 15, on page 1066, have been approved by the Interstate Commerce Commission, and made effective on and after July 9, 1914. In connection with this the Special Committee on Relations of Railway Operation to Legislation in Bulletin No. 62 has published the following additional interpretations and rules made by the sub-committee of mechanical officers:

Rule 2.—119. Application for extension of time under this rule to be made by individual railways affected.

Rule 10.—120. The removal of superheater tubes every three years will not be required provided the tubes are in good condition, and the boiler can be thoroughly cleaned and inspected without their removal.

Rule 21.—121. All work required to be done monthly should be done when the boiler is taken out of service for inspection. Staybolts should be tested the same day the boiler is washed or before it is returned to service.

122. If staybolts, which are behind brick work on oil burning locomotives or behind grate bearers, have a tell-tale hole three-sixteenths inch in diameter their entire length which is kept open at all times, the removal of the brick work or grate bearers each month for the purpose of hammer testing such bolts will not be required. This will not, however, relieve from making a thorough inspection each time the brick work is removed, nor will it relieve from removing the brick work for an inspection when necessary.

Rule 52.—123. This rule effective January 1, 1915. Until that date quarterly cards, Form No. 2, may be used if in stock. Cab cards need not be certified to.

Rule 54.—124. When any locomotive is condemned, scrapped or sold, a final report on Form No. 3 giving both locomotive and boiler number should be filed with the district inspector. This should be certified to by the chief mechanical officer, or mechanical engineer. Further reports for such locomotive need not be filed. If boiler only is scrapped, and locomotive continued in service with new boiler, report should so state.

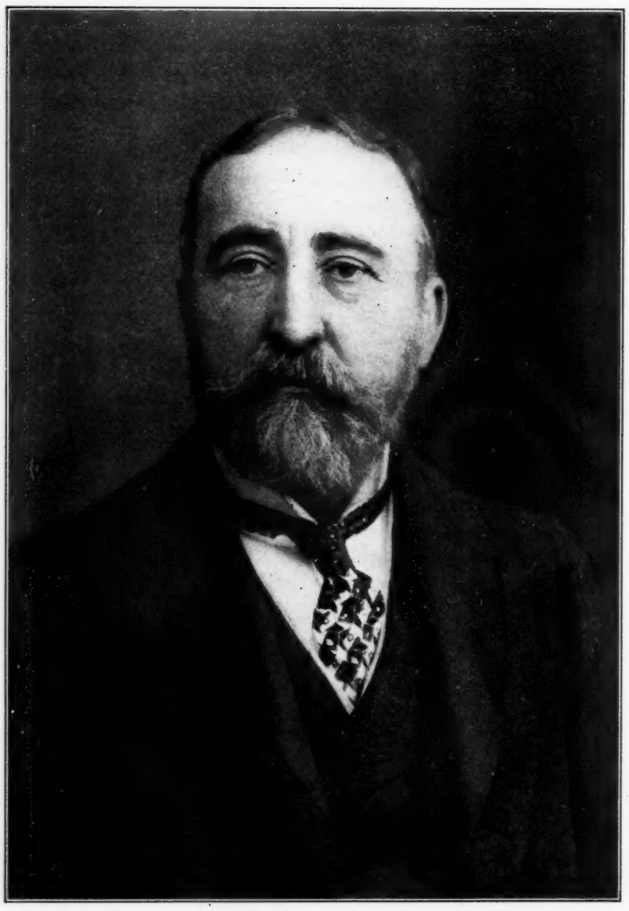
Rule 52.—Interpretations 72 and 73 are withdrawn as obsolete.

RAILWAYS IN ASIA MINOR.—It was announced in Rome on May 19 that a definite agreement had been signed by an Italian syndicate and the English Smyrna-Aidin Railway Company regarding railways in Asia Minor.

RAILWAY CONSTRUCTION IN SPAIN.—At the present time there are several railway projects under consideration by the Spanish authorities. A line from Valencia to Calatayud has been built and in operation for some years. A contract and concession for an additional strategic railway from the latter point via Sorisa to Burgos will soon be let. This line is connected with the line from Burgos via Arconada and Monco to Ontaneda, a suburb of Santander, and will give a through route from Valencia to the north coast of Spain. The Ministerio de Fomento has recently approved a project for a strategic line from Ferrol to Gijon via Ribadeo. This line will receive from the government a five per cent. guarantee on the cost of construction; it will connect at San Esteban de Pravia with the line from Ujo to Pravia, thus connecting the latter, Oviedo, Santander, Bilbao, San Sebastian and Hendaye on the French frontier with the Noroeste de Espana Railway. The line will also connect at Ribadeo with the Ribadeo-Valladolid, a project which has also been approved by the government. It is also reported that work on the new line from Palanquinos, near Leon, via Valencia de Don Juan, to Medina de Rioseco is well advanced. A project has also been approved for a secondary railway from Cervera to Saragossa. There is under consideration a project for a line from Cervera to Tarragona, with a branch from Belumet to Igualada and for a line from Zamora to Orense, in northwestern Spain. A company has also been formed to construct and operate a railway from Ribadesella to Gijon, also in northwestern Spain.

MELVILLE E. INGALLS

Melville E. Ingalls, who pieced together the Cleveland, Cincinnati, Chicago & St. Louis, and who was also for twelve years president of the Chesapeake & Ohio, died on Saturday, July 11, at Hot Springs, Va. Mr. Ingalls was 72 years old, and had resigned as chairman of the board of the Big Four in 1912. He was a shrewd Yankee lawyer in good standing when he became president of the Indianapolis, Cincinnati & Lafayette in 1870. Without previous railroad training, he was nevertheless quick to pick up a general knowledge of both operation and traffic. He was a keen business man, and saw the possibilities of buying small railroad properties and combining them into a system. He managed the properties well, and the building up of such a system as the Big Four was probably of great benefit to the territory which the system now serves. On the other hand, Mr. Ingalls' genius did not comprehend a homogeneous railroad system. In part, of course, this was due to the fact that the nature of the territory and of the already existing short lines necessitated a rather patch-work railroad system, but in part also it was because Mr. Ingalls either could not or did not know how to acquire his properties outright. The Big Four, as he built it up, was a network of lines operated by one company, but held under a great variety of forms of tenure. On some there were trackage rights only; with others there was some form of operating agreement; on others an outright lease, and so on. With this system, in the tremendously highly competitive territory in which it is, Mr. Ingalls' administrations did remarkably well.



Melville E. Ingalls

Mr. Ingalls was president of the Chesapeake & Ohio from 1888 to 1900. During that time the mileage was increased from 931 miles to 1,476 miles. The gross operating revenue increased from $7,162,000 to $13,402,000. The coal and coke tonnage increased from 1,465,000 tons to 4,679,000 tons. It is no criticism to say that, as in the case of the Big Four, Mr. Ingalls could not foresee what the future developments of the Chesapeake & Ohio would be. The fact that the Chesapeake & Ohio is not as firmly intrenched today in the coal fields of West Virginia as is the Norfolk & Western is in part due to the difference in policy pursued by the management of the Norfolk & Western in the ten years 1890 to 1900, and that pursued by Mr. Ingalls' management of the Chesapeake & Ohio.

Melville Ingalls was born in 1842 in Maine. He became president of the Indianapolis, Cincinnati & Lafayette in 1870, and in the following year was made receiver. The company was reorganized in 1873 with Mr. Ingalls as president, but in 1876 the company had again got into difficulties, and went through another receivership under Mr. Ingalls, being reorganized in 1880 as the Cincinnati, Indianapolis, St. Louis & Chicago. Mr. Ingalls was president of this company up to June 27, 1889, when it was consolidated with the "Bee" Line, the Cleveland, Columbus, Cincinnati & Indianapolis. The consolidated company was the Cleveland, Cincinnati, Chicago & St. Louis, of which Mr. Ingalls was president until February 1, 1905, at which time he resigned to become chairman of the board, holding this office until November, 1912. From 1881 to 1883 Mr. Ingalls was president of the Kentucky Central, and, as previously mentioned, was president of the Chesapeake & Ohio from 1888 to 1900.

THE CAPE COD CANAL

The Cape Cod canal, connecting the waters of Cape Cod Bay with those of Buzzard's Bay, and separating Barnstable County from the rest of Massachusetts, is nearly finished, and it is announced that it will be opened for traffic on July 29. But it has not yet been dug for the full depth throughout its length, and at first no vessels will be admitted to the canal except those drawing 15 ft. or less. Larger vessels cannot pass through before September, when it is expected to have a depth of 25 ft.

The length of the canal is 8 miles, and the distance from deep water on the east to deep water on the west is about 13 miles. The width of the canal at the bottom is 100 ft., but at two places it is made twice as wide to provide meeting places. By this canal, the water route between Long Island Sound and Boston harbor is shortened about 70 miles; and it is calculated that the saving in time will be greater in proportion than the sailing distance because outside of Cape Cod fogs are more prevalent. In a given time the duration of fogs at Pollock Rip was 1,066 hours, as compared with 625 hours at the eastern entrance of the canal. The cost of marine insurance also is expected to be considerably less.

There is no lock in this canal, and the difference in the height of the tides at the east and the west ends is never greater than 5 ft. At the highest point of land the surface of the water in the canal is 29 ft. below the top of the cut. The canal is spanned by three drawbridges, two for highways and one for the tracks of the New York, New Haven & Hartford Railroad.

The canal has been dug by the Boston, Cape Cod & New York Canal Company, of which August Belmont, of New York, is president, and J. W. Miller, formerly at the head of the Fall River Line of steamers, is vice-president. The chief engineer is W. Barclay Parsons. The work has taken five years, and the cost of it is given as $12,000,000.

The Cape Cod Construction Company, with headquarters at 43 Exchange Place, New York City, acting as agent for the canal company, has issued the following tariff of tolls:

FOR VESSELS LESS THAN 16 GROSS TONS BASED ON LENGTH OVER ALL

	Class A*	Class B†	Class C‡ With cargo	Class C‡ Without cargo
Minimum less than 15 ft...	$3	..	..	.....
15 ft. to 19 ft.....	4	..	..	.....
20 ft. to 24 ft.....	6	..	..	.....
25 ft. to 29 ft.....	8	$8	$6	$3.00

30 ft. to 34 ft.	10	10	7	3.50
35 ft. to 39 ft.	12	12	8	4.00
40 ft. to 44 ft.	15	15	10	5.00
45 ft. to 49 ft.	17	17	12	6.00
50 ft. to 54 ft.	20	20	14	7.00
55 ft. to 59 ft.	22	22	15	7.50
60 ft. to 64 ft.	25	25	17	8.50
65 ft. and over and less than 16 gross tons	30	30	21	10.50
FOR VESSELS OVER 16 GROSS TONS				
16	25	25	17	8.50
17	26	26	18	9.00
18	28	28	19	9.50
19	30	30	20	10.00
20 to 24	31	31	21	10.50
25 to 29	32	32	22	11.00
30 to 34	33	33	23	11.50
35 to 39	35	35	24	12.00
40 to 44	37	37	25	12.50
45 to 49	40	40	28	13.00
50 to 74	45	45	31	14.00
75 to 99	50	50	35	15.00
100 to 124	55	55	38	16.00
125 to 149	60	60	42	17.00
150 to 199	65	65	45	18.00
200 to 249	70	70	48	19.00
250 to 299	72	72	50	20.00
300 to 349	74	74	52	21.00
350 to 399	76	76	53	22.00
400 to 449	78	78	54	23.00
450 to 499	80	80	56	24.00
500 to 549	82	82	..	.....
550 to 599	84	84	..	.....
600 to 649	86	86	..	.....
650 to 699	88	88	..	.....
700 to 749	90	90	..	.....
750 to 799	92	92	..	.....
800 to 849	94	94	..	.....
850 to 899	96	96	..	.....
900 to 949	98	98	..	.....
950 to 999	100	100	..	.....

*Yachts, motor boats and vessels not engaged in commercial trade. Government vessels shown in government books under Gross Tonnage.
†Vessels engaged in commercial trade carrying passengers only, passengers and freight, and miscellaneous freight, or in ballast.
‡Vessels carrying crude material in bulk cargo lots.

For Class A and Class B vessels of over 1,000 gross tons the rate is ten cents per gross ton per single passage. In Class C vessels over 500 gross tons will be charged on the basis of their having on board 800 tons of cargo at 7 cents per cargo ton per single passage. Vessels over 500 gross tons without cargo, five cents per gross ton per single passage. The total tonnage of cargo in vessels in tow is to be computed as if on board a single vessel. Tolls include the towing tug provided by the owners of barges or schooners.

The officers of the canal company calculate that the saving in time and the increase in safety will draw to the canal route 7,000,000 tons of coal and lumber yearly—this is only about a third of the twenty or twenty-five million tons of freight carried through Vineyard Sound every year—and they also expect to attract passengers, as well as freight, for the summer resorts of the Cape Cod region. It does not appear that any of the large shippers have as yet made application for the privileges of the canal, or that the canal company has tested the acceptability of its rates, from the standpoint of the vessel owners; but attractive rates ought to be practicable even allowing for some exaggeration in the estimates of economies; for the average trip of coal schooners and barges around the cape is said to be four days longer than will be necessary by the direct route through the canal.

WESTERN MARYLAND CONSOLIDATION LOCOMOTIVE

The American Locomotive Company recently delivered 20 consolidation type locomotives, having a tractive effort of 61,300 lb. each, to the Western Maryland. These were built to give the greatest possible tractive effort obtainable within the axle load limitations.

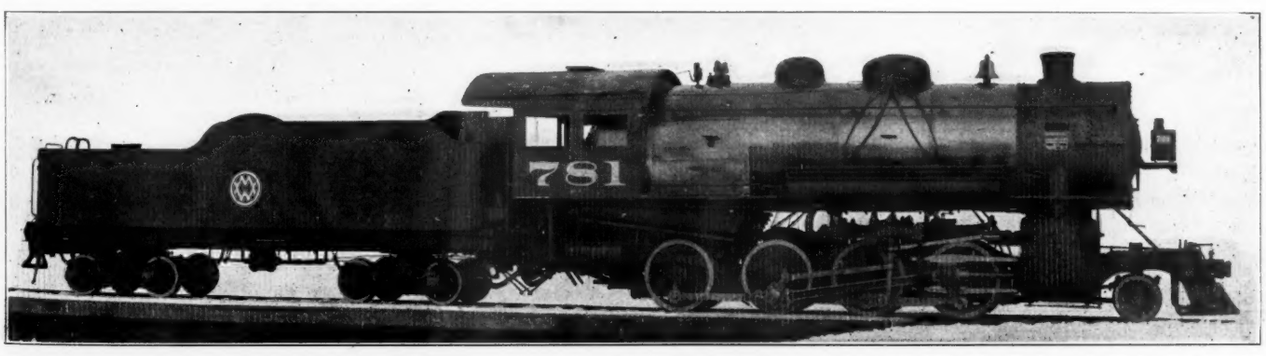
The mechanical department of the Western Maryland, after carefully studying the physical conditions of the division on which these locomotives are to be used, decided that the comparatively low factor of adhesion of 3.55 could be safely used. By the use of this factor of adhesion and driving wheels 51 in. in diameter, the tractive effort of 61,300 lb. was obtained without sacrificing boiler capacity. It is, therefore, interesting to note the work these locomotives are doing, showing the possibilities of this type with a relatively small driving wheel for service where speed does not become a factor.

After leaving Cumberland, eastbound, the line runs over an undulating profile, on which the maximum grade against eastbound traffic is 0.3 per cent. for 74 miles to Williamsport, Md. From here it rises on a one per cent. grade into Hagerstown, about six miles. On this division the railway estimated that these locomotives would haul 4,725 tons.

On May 20, 1914, one of the locomotives left Cumberland at 2:30 a. m. with 114 loaded cars, weighing 7,014 tons, and arrived at Williamsport at 9:18 a. m. At this point 15 loads were set off, and the train was given two Mallet helpers, leaving at 10:04 a. m., and arriving at Hagerstown at 11:05 a. m., the crew having been on duty 8 hr. 35 min. from the time they were called until released at Hagerstown. Many similar runs have since been made.

The boiler is of the straight top type, 82 in. in diameter at the front end and 87 in. at the largest course. There are 239 tubes, 2¼ in. in diameter, and 36 flues, 5½ in. in diameter and 15 ft. 3 in. long; the tube spacing is 13/16 in. The firebox is 110 in. long and 80¼ in. wide, and has a throat depth of 22 in., measurement being taken from the top of the grate to the center of the lowest tube.

According to the American Locomotive Company's new ratios, 25 in. cylinders with 200 lb. boiler pressure give 2,252 cylinder horsepower. One horsepower hour requires 20.8 lb. of superheated steam, and the total steam required per hour is 2,252 times 20.8, or 46,840 lb. The firebox and firebox water tubes give an evaporation of 55 lb. of steam per square foot of heating surface; tubes 2¼ in. in diameter, 15 ft. 3 in. long, spaced 13/16 in., give an evaporation of 10.605 lb. per square foot of heating surface; and flues 5½ in. in diameter, 15 ft. 3 in. long, spaced 13/16 in., give an evaporation of 11.625 lb. per square foot of heating surface. This boiler has a heating surface in the firebox and firebox water tubes of 228.5 sq. ft.; in the tubes, 2,133.7 sq. ft., and in the flues 785.6 sq. ft.; the evaporation for the firebox and water tubes is 228.5 x 55, or 12,570 lb.; for the tubes, 2,133.7 x 10.605, or 22,630 lb.; for the flues, 785.6 x 11.625, or 9,200 lb., giving a total evaporation of 44,330 lb. The evapora-



Western Maryland Consolidation Locomotive with 51 inch Drivers

tion of the boiler, 44,300 lb., divided by the evaporation required, 46,840 lb., indicates a 95 per cent. boiler.

Maximum cylinder horsepower would not be reached until this engine was running 31 miles an hour. As the service in which the engines are working will not require any such speed, a 95 per cent. boiler should have ample steam making capacity. H. R. Warnock, superintendent motive power of the Western Maryland, states that with the poorest quality of coal he has ever seen, the fireman had no trouble in opening the second safety valve.

This design was developed by the mechanical department of the Western Maryland in co-operation with the American Locomotive Company as a part of the program of this road in reducing operating costs. The details employed in the construction include the Baker valve gear, firebrick arch, superheater, outside steam pipes, Woodard engine truck, long main driving box, Foulder main rod and vanadium cast steel frames.

The principal dimensions follow:

General Data

Gage	4 ft. 8½ in.
Service	Freight
Fuel	Bit. coal
Tractive effort	62,500 lb.
Weight in working order	244,500 lb.
Weight on drivers	217,500 lb.
Weight on leading truck	27,000 lb.
Weight of engine and tender in working order	424,000 lb.
Wheel base, driving	16 ft. 8 in.
Wheel base, total	26 ft. 2 in.
Wheel base, engine and tender	68 ft. 0 in.

Ratios

Weight on drivers ÷ tractive effort	3.52
Total weight ÷ tractive effort	3.91
Weight on drivers ÷ total equivalent* heating surface	53.84
Total weight ÷ total equivalent* heating surface	60.53

Cylinders

Kind	Simple
Diameter and stroke	25 in. x 30 in.

Valves

Kind	Semi-plug
Greatest travel	6½ in.
Outside lap	1 in.
Inside clearance	Line and line
Lead	⅛ in.

Wheels

Driving, diameter over tires	51 in.
Driving journals, main, diameter and length	11 in. x 20 in.
Driving journals, others, diameter and length	9 in. x 12 in.
Engine truck wheels, diameter	30 in.
Engine truck, journals	6 in. x 12 in.

Boiler

Style	Straight top
Working pressure	200 lb.
Outside diameter of first ring	83¾ in.
Firebox, length and width	111 in. x 80¼ in.
Firebox plates, thickness	⅜ in.
Firebox, water space	4½ in. and 4 in.
Tubes, number and outside diameter	239—2¼ in.
Flues, number and outside diameter	36—5½ in.
Tubes, length	15 ft. 3 in.
Heating surface, tubes and flues	2,919.3 sq. ft.
Heating surface, firebox	202.0 sq. ft.
Heating surface, water tubes	26.5 sq. ft.
Heating surface, total	3,147.8 sq. ft.
Total equivalent* heating surface	4,039.4 sq. ft.
Superheater heating surface	594.4 sq. ft.
Grate area	61.3 sq. ft.

Tender

Tank	Water bottom
Wheels, diameter	33 in.
Journals, diameter and length	6 in. x 11 in.
Water capacity	9,500 gal.
Coal capacity	14 tons

*Total equivalent heating surface = total evaporative heating surface + 1.5 times the superheating surface.

ADDITIONAL ROLLING STOCK FOR THE SWISS RAILWAYS.—The directors of the Swiss railways have recently approved contracts for the delivery of 32 locomotives in 1915 and also contracts for the purchase of 142 passenger cars, 42 baggage cars and 390 freight cars. The project for the reconstruction of the Federal Railways power plant in the Rhone river at Brieg and the laying of high power transmission cables in the second Simplon tunnel has also been approved, as well as that for the erection of other transmission lines in that vicinity for which a total expenditure of $378,280 will be required.

RAILROAD STATISTICS TO JUNE 30, 1913

The Interstate Commerce Commission has issued its preliminary statement of the earnings, expense and traffic and financial statistics of *railroads having annual operating revenues of over* $100,000, and of subsidiary non-operating companies operated by them, but not including switching or terminal companies, for the twelve months which ended one year ago. The principal items of the statement are tabulated below, but some of the figures for the year preceding are taken from the statement issued last year, which was given in the *Railway Age Gazette* of August 1, 1913, page 180. Where statistics of operating companies include transactions which are reported also by owning companies, there is a duplication, at end of year the amount of which does not appear. Other items, such as capital stock of one road owned by another, make a fictitious element in the totals.

Statistics of Class 1 and Class 2 Railroads—Year Ending June 30, 1913

	Year ending June 30, 1913	Year ending June 30, 1912
Miles of line operated at end of year	244,418	240,239
Miles of trackage rights included in above	11,163	10,825
Average miles operated during year	242,657	238,220
Miles of track	369,580	360,952
Locomotives	63,378	61,276
Locomotives per 1,000 miles	259	255
Cars, passenger service	51,700	50,606
Cars, freight service	2,273,564	2,203,128
Cars, company's service	120,244	114,924
Cars, total	2,445,508	2,368,942
Cars, per 1,000 miles	10,005	9,860
Passenger miles per passenger locomotive	2,341,269	2,263,019
Ton miles per freight locomotive	7,843,663	7,077,428
Employees, June 30	1,815,239	1,699,941
Employees per 100 miles	743	707
Capital stock, *thousands*	$8,610,611	$8,469,561
Funded debt, *thousands*	$11,185,514	$11,064,190
Dividends declared	$368,606,327	$400,432,752
Dividends, average, per cent	4.28	4.73
Dividends, average, per cent. on dividend-paying stocks	6.38	7.20
Cost road and equipment, *thousands*	$16,351,639	$15,874,579
Passengers carried, *thousands*	1,033,680	994,372
Passengers carried one mile, *thousands*	34,575,873	33,039,111
Passenger mileage per mile of road	143,067	140,393
Freight carried, *thousands* of tons	2,058,035	1,818,796
Ton miles, *millions*	301,399	263,780
Increase, *millions*	37,619	.....
Ton miles per mile of road	1,245,158	1,110,811
Average freight train load, tons	445	410
Average receipts per passenger mile, cents	2.008	1.985
Average receipts per ton mile, mills	7.29	7.43
Average receipts per passenger train mile	$1.36	...
Average receipts per freight train mile	$3.24	...
Average receipts per revenue train mile, freight and passenger	$2.45	$2.30
Average operating expenses per revenue train mile	$1.70	$1.60
Per cent. expenses	69.44	69.30
Passenger revenue, *thousands*	$695,988	...
Freight revenue, *thousands*	2,198,931	...
Total revenue, including miscellaneous, *thousands*	3,125,136	$2,826,958
Operating expenses, *thousands*	2,169,969	1,959,095
Operating expense details, *thousands*—		
Maintenance of way	421,232	363,496
Maintenance of equipment	511,561	448,304
Traffic	62,850	60,569
Transportation	1,096,253	1,013,341
General	78,072	73,254
Revenue per mile	12,873	11,881
Operating expenses per mile	8,939	8.234

The item, cost of road and equipment, in 1913 is $477,059,640 larger than in 1912. The changes are explained as follows:

	Expenditures for additions and betterments.	Expenditures for new lines and extensions.	
From cash or other working assets	$329,511,772	$54,819,241	
From special appropriations	48,079,165	473,281	
Through issue of securities	162,597,278	63,692,746	
Not assigned to any of the above classes	5,801,127	10,263,251	
Total	$545,989,342	$129,248,519	$675,237,861
Miscellaneous charges not classified			4,847,012
Total expenditures during year			$680,084,873
	Credits.		
Property retired or converted	*$79,495,571*		
Adjustments	*5,058,790*		
Difference between record value of grantor and purchase price of grantee in cases of roads sold, merged, consolidated, etc.	*118,470,872*		
Total			*203,025,233*
Net increase during year			$477,059,640

The capacity of freight cars is reported as follows:

	Number	Aggregate capacity. Tons
Box	1,032,585	35,607,134
Flat	147,541	5,151,054

	Number	Aggregate capacity. Tons
Stock	78,308	2,421,827
Coal	871,339	38,314,920
Tank	8,216	327,727
Refrigerator	43,389	1,357,403
Other cars in freight service	91,911	3,798,080
Total	2,273,289	86,978,145

CONDENSED INCOME ACCOUNT

Following is a condensed income account of the roads included in this list, below which is a similar statement for the controlled, non-operating companies, both incomplete because of the omission of a few unsatisfactory returns. The accounts of the operating roads include both operating and financial transactions, while the accounts of the non-operating roads are confined for the most part to receipts and payments under leases, contracts and agreements. For a number of items, such as dividends, taxes, etc., both statements must be taken into consideration in order to learn the aggregates of such items for the railways of the United States therein represented.

Thus the aggregate of dividends declared during the year, $368,552,632, includes those declared out of current income and those declared from surplus both by the operating roads and by the non-operating roads. This amount includes dividends declared on railway capital stock owned by other railway companies.

OPERATING ROADS

Income Account

Rail operations:		
Operating revenues	$3,125,135,798	
Operating expenses	2,169,968,924	
Net operating revenue		$955,166,874
Outside operations:		
Revenues	$67,982,036	
Expenses	65,953,702	
Net revenue from outside operations		2,028,334
Total net revenue		$957,195,208
Taxes accrued		122,005,424
Operating income		$835,189,784
Other income		283,063,093
Gross income		$1,118,252,877
Rents, interest, and similar deductions from gross income		629,706,398
Net corporate income		$488,546,479
Disposition of net corporate income:		
Dividends declared from current income	$241,750,512	
Appropriations for additions and betterments	48,022,688	
Appropriations for new lines and extensions.	70,159	
Miscellaneous appropriations	14,991,076	
Stock discount extinguished through income.	6,497	
Total		304,840,932
Balance to credit of profit and loss		$183,705,547

Profit and Loss Account.

Credit balance on June 30, 1912	$1,078,765,200
Credit balance for year 1913 from income account	183,705,547
Total	$1,262,470,747
Dividends declared out of surplus	85,706,629
Difference	$1,176,764,118
Appropriations for additions and betterments	$15,158,827
Appropriations for new lines and extensions	449,652
Miscellaneous appropriations	68,723,482
Other profit and loss items—debit balance	20,691,684
Total	105,023,645
Balance credit June 30, 1913, carried to balance sheet.	$1,071,740,473

NONOPERATING ROADS

Income Account

Gross income from lease of road	$124,332,275	
Taxes accrued	5,326,536	
Net income from lease of road		$119,005,739
Other income		7,777,635
Gross income		$126,783,374
Interest, and similar deductions from gross income		68,568,734
Net corporate income		$58,214,640
Disposition of net corporate income:		
Dividends declared from current income	$38,845,422	
Appropriations for additions and betterments	2,140,855	
Appropriations for new lines and extensions.	59,491	
Miscellaneous appropriations	1,274,520	
Total		42,320,288
Balance to credit of profit and loss		$15,894,352

Profit and Loss Account.

Credit balance on June 30, 1912		$57,158,330
Credit balance for year 1913 from income account		15,894,352
Total		$73,052,682
Dividends declared out of surplus		2,250,069
Difference		$70,802,613
Appropriations for additions and betterments	$500,665	
Appropriations for new lines and extensions	208	
Miscellaneous appropriations	29,945,358	
Other profit and loss items—credit balance	2,932,044	
Total		27,514,187
Balance credit June 30, 1913, carried to balance sheet.		$43,288,426

THE LOUISVILLE & NASHVILLE PASS INVESTIGATION

The Interstate Commerce Commission has submitted a preliminary report to the Senate in compliance with Senate Resolution 153 relating to the financial relations, rates and practices of the Louisville & Nashville, the Nashville, Chattanooga & St. Louis and other carriers. The report is a response to paragraph 13, in particular, and contains what is considered by the commission to be startling information concerning the granting of passes by these roads. The results cover only one year, whereas the resolution requires the commission to investigate passes granted to the specified classes for a period of three years. The results for this one year apparently so fully reveal prevailing conditions in this respect that the commission doubts the necessity of covering 1912 and 1911.

During the year ending December 31, 1913, the Louisville & Nashville issued to or on account of members of legislative bodies and other public officials, attorneys, newspaper representatives, and various other persons, 11,805 free passes, involving 4,577,928 miles of travel, the value of which was $130,840.

These were distributed as follows:

Class	Number of passes	Mileage	Value
Members of legislative bodies and other public officials	6,578	2,155,465	$61,727
Attorneys	1,402	874,341	24,520
Newspaper representatives	2,631	1,119,060	32,247
Various other persons	1,194	429,062	12,346
Total	11,805	4,577,928	$130,840

The resolution made particular reference to passes issued to and at the request of members of legislative bodies or other public officials:

Total of all forms of passes	Number of passes	Mileage	Value
Issued to such members or officials	1,942	1,152,150	$32,632
Issued at their request	4,636	1,003,315	29,095
Total	6,578	2,155,465	$61,727

The passes shown above as issued on account of members of legislative bodies or other public officials were distributed as follows:

On account of	Number of passes	Mileage	Value
United States senators	1	...	...
United States representatives	2	204	$6
Other United States officials	139	56,558	1,676
State senators	1,556	390,383	11,324
State representatives	2,183	505,201	14,850
Other state officials	1,769	839,567	23,996
County officials	228	167,802	4,674
City officials	611	149,290	4,021
Judges	89	46,460	1,180
Total	6,578	2,155,465	$61,727

In the same period the Nashville, Chattanooga & St. Louis issued to or at the request of members of legislative bodies and other public officials, attorneys, representatives of newspapers, and various other persons 22,255 passes, involving 7,133,914 miles of travel, the value of which was $209,421.

These were distributed as follows:

Class	Number of passes	Mileage	Value
Members of legislative bodies and other public officials	16.580	5.573,135	$164,525
Attorneys	291	153,261	4,443
Newspaper representatives	1,310	348,738	10,096
Various other persons	4,074	1,058,810	30,447
Total	22,255	7,133,944	$209,421

Passes were issued to and at the request of members of legislative bodies and other public officials as follows:

Total of all forms of passes	Number of passes	Mileage	Value
Issued to such members or officials	1,247	613,420	$18,087
Issued at their request	15,333	4,959,715	146,438
Total	16,580	5,573,135	$164,525

The passes shown above as issued on account of members of legislative bodies and other public officials were distributed as follows:

On account of	Number of passes	Mileage	Value
United States senators	...	...	...
United States representatives	...	...	...
Other United States officials	151	37,757	$1,097
State senators	5,814	1,788,560	52,961
State representatives	8,439	2,969,038	87,713
Other state officials	1,086	444,158	13,089
County officials	388	130,540	3,700
City officials	532	143,125	4,165
Judges	170	59,957	1,800
Total	16,580	5,573,135	$164,525

The commission's comments on these figures are as follows:

It must be remembered that the passes here enumerated cover only passes held by classes of persons specified in the resolution. The list does not embrace, for instance, passes granted to officers and employees of railroad companies.

The examiners of the commission have reported only the amount of travel actually established through an examination of the companies' records. Due to the incompleteness of the reports of the conductors of passenger trains the exact amount of free travel on the part of the classes of persons embraced within the inquiry could not be correctly ascertained. It is doubtless substantially greater than what is here reported.

The examiners also compiled illustrative correspondence tending to show the motives which actuated recipients and givers in these pass transactions. These letters, as might be expected, reflect many varieties of states of mind on the part of the givers and of the seekers after favors from the timidly suggestive to the boldly intimidating and threatening.

In order to properly compile the required information lists of pass holders in the various classes were prepared. Such lists reveal the manner in which these carriers have dipped into practically every domain of public and private life through the instrumentality of the free pass. There is scarcely a walk of life which is not represented in this procession of recipients of passes from the federal bench to the local politician and the sheriff who summons the jury. The threads represented by these passes tie thousands of citizens to the carriers through improper relations. The lack of morality reflected by the facts here compiled is a menace to the institutions of a free people. These citizens who sell their influence quite as much as though they accepted money bribes seem to be as willing to be tied as the carriers are ready to tie them. Men pledge their influence quietly in the home or school or club, in the professions, in business, in city councils; in administrative boards, in courts of justice, in legislative halls and at the polls.

As shown by the above tables the aggregate value of the actual travel upon these passes which it was possible to establish statistically is $340,261. This is a substantial sum. If all the travel upon the passes in question could have been established the sum would doubtless have been materially increased; yet it is not an amount which can financially cripple any large system of railways. The financial magnitudes involved, however, are as nothing compared with the impairment of public and private morality shown to have resulted from this giving and receiving of passes. The lamentable features of the situation are so perfectly obvious that they scarcely require further characterization.

This investigation being pursuant to a resolution of the Senate is not one in which the commission can make an order. It states, however, that it has had in progress for some time a general investigation of free transportation, and that it is its intention in that investigation to issue an order dealing with that practice.

MOTION PICTURES OF RAILWAY MISHAPS

The use of motion pictures by the Pacific Electric Company for teaching the importance of certain regulations for the prevention of collisions and for inculcating other rules was noticed in the *Railway Age Gazette* of June 26, page 1567. Following are descriptions of some of the pictures used:

One reel represents a dangerous crossing. The track of a steam railroad, hugging the bank of a river, makes a sharp curve at this point, and the road of the electric line emerges from a maze of warehouses and other large buildings to enter upon a bridge beyond. The picture shows a crowded electric car approaching the crossing. The motorman stops the car a few yards short of the crossing track, and the conductor, stepping off and absently glancing at a newspaper held in his hand, which some passenger has handed to him, walks out in front of his car. Still absent-minded, he glances down the crossing track in one direction, and gives the signal to the motorman to proceed. The car begins to move. At the same instant, from the direction in which he failed to look, comes into view a noiseless but swiftly moving switching engine. It is rapidly nearing the crossing. The conductor, at last hearing the sound, drops his paper and stands for just a second, paralyzed with horror. Then he rushes in front of the electric car and begins to frantically wave his arms. But the motorman has already seen the danger, and has quickly shut off the current and applied the brakes. The passengers have in the meantime also observed the impending danger and are panic-stricken. The brakes are set, the wheels slide and the car comes to a stand within less than five feet of the crossing. The conductor scarcely has time to step to one side to safety as the switch engine goes whizzing by.

This constitutes the first scene. The companion picture shows the proper procedure for such situations.

Another set shows a car that has become stalled on a suburban track at night. It is a track used exclusively by fast trains, and the electric cars are scheduled to run only a few minutes apart. The line has a number of curves and traverses several deep cuts. A flagman is sent back to place torpedoes and to give a lamp motion signal to possible approaching trains. But he is tired and careless, and neglects to go back a sufficient distance. He waits for several minutes, and finally sits down on one of the rails with his lantern between his feet. Soon there is a flash of a headlight playing on the sides of the cuts, and the flagman jumps up and begins to swing his lantern. The approaching train comes on, traveling at perhaps forty miles an hour. The motorman of this train then sees the signal, and quickly applies his brake, but he passes the flagman with grinding wheels, while still going at uncontrollable speed; and, the distance allowed by the flagman being insufficient to overcome the momentum, crashes into the standing car.

Just such an accident actually occurred on one of the lines of this company several months ago, and several lives were lost.

A companion picture shows how the signaling should have been done, according to the rules.

As pedestrians persist in walking on railway bridges and trestles, most electric railways require their motormen to slacken speed when entering on a bridge or trestle, especially within city limits. One of the pictures shown in the instruction department of this Los Angeles company shows a pedestrian trespassing on a bridge, when a car swoops down upon him, and the car is only brought to a standstill just as the guard strikes the trespasser. The conductor escorts the careless pedestrian to one end of the trestle, and directs his attention to the warning sign.

Another reel constitutes a warning against the practice of alighting from one car, passing around behind it, and, without looking, stepping directly in front of another car moving in the opposite direction on the other track. The motorman of the moving car when passing a standing car from which passengers are alighting is supposed to slacken speed and ring his bell. Often, however, he is careless and fails to observe the rule. Pictures are shown to illustrate how accidents may be caused

in this way, and also how care should be exercised to avoid them.

The motion pictures are used also to inculcate habits of courtesy toward passengers. One shown by the Pacific Electric presents a more or less familiar and humorous episode—the conductor of an electric car, a handsome young fellow, standing and talking to a pretty young woman sitting in a seat at the front end. He is entirely oblivious to everyone except the girl. A fat old lady rises from one of the rear seats and approaches the exit. She has reached her street and wants to get off. Instead of stopping to permit her to do so, however, the car passes on, while the old lady waves her hands and yells to the conductor. Finally some other passenger directs the conductor's attention to the excited passenger, and after carrying her three or four blocks beyond her destination, he stops the car and lets her off.

These are only a few of the pictures used. They illustrate all phases of train management, including a portrayal of how trains should be handled through interlocking plants; the operation of electric train-staff machines; how to use crossover tracks on a four-track line in high-speed sections where the view is obstructed; what to do when unable to clear the leaving time of an opposing superior train, and proper procedure at steam railroad grade crossings; how to make tests of air brakes, how to couple and uncouple cars; picking up broken trolley wires; the necessity of complying with the rule when approaching curves protected by the "slow" sign; the danger of giving the back-up signal without ascertaining if it is safe to move backward; what to do when approaching a dangerous road crossing where there is no flagman or flagging device; hand and lamp signals; how to use fusees and set torpedoes, and numerous other things.

This method of instruction has proved to be not only effective in giving trainmen a clear, comprehensive knowledge of their duties, but, being highly interesting and entertaining, it eliminates the necessity of using coercive methods to get them to attend instructions. The advantage of being able to instruct a large class of men in much less time than formerly is important, as the company employs nearly 5,000 men, of whom nearly 2,000 have duties in connection with train operation.

The Pacific Electric Railway Company's system serves an area of approximately 2,500 square miles in the vicinity of Los Angeles, and operates over 1,067 miles of track. It has 650 passenger cars, 1,452 freight cars, of different kinds, and 66 electric locomotives of from 200 to 1,000 horsepower each. It carries approximately 97,000,000 passengers annually, or about 266,000 daily. A total of 7,172 passenger trains, of from one to three cars each, is despatched over the system daily. Although it is primarily a suburban system, being entirely independent of the system handling the city traffic of Los Angeles, 4,800 trains each day handle city traffic, principally in the small cities and towns surrounding Los Angeles. If all service on the system were to be suddenly stopped and re-started at one time, 50,000 horsepower of electrical energy would be required. The lines extend from sea level to a point 5,800 feet above sea level.

RAILWAY CONSTRUCTION IN SPANISH AFRICA.—The chief engineer of public works in the colonial section of the department of state of Spain has submitted a project for a complete system of railways in the Spanish colony of Fernando Po. The total length of the proposed system when completed will be 115 miles, as follows: From Santa Isabel to San Carlos, 28 miles; from San Carlos to Ococo, 12 miles; from Santa Isabel to Concepcion, 44 miles; from Concepcion to Ureca, 12 miles, and from Rilaja to Moca, 19 miles. It is urged that the line from Santa Isabel to San Carlos, which will run through the richest and most popular section of the colony, should be first constructed, beginning at Santa Isabel. This line, in conjunction with the proposed line from Santa Isabel to Concepcion, will serve the north and the middle of the island while the line from Rilaja to Moca will give access to the healthy plateaus.

GENERAL FOREMEN'S CONVENTION

The tenth annual convention of the International Railway General Foremen's Association was held at the Hotel Sherman, Chicago, July 14-17, W. W. Scott, of the Delaware, Lackawanna & Western, at East Buffalo, N. Y., presiding. The meeting was opened with prayer by Reverend Peter J. O'Callaghan, after which an address of welcome was delivered by Leo N. Hornstein, on behalf of the mayor of Chicago. This was responded to by W. T. Gale, of the Chicago & North Western.

President Scott, in his address, said: "As far as the mechanical department is concerned our efforts have not been sufficiently brought to the light of public recognition." He then made the following recommendations: That the subjects presented at this convention for discussion be retained for next year except for the two subsidiary papers; that the number of members named on committees be increased to ten, and that their selection be from widely separated territory in order that all data due to climatic or any other unusual conditions may be observed; that subject 2 (valves, cylinders, crossheads, pistons and guides) cover erecting, bench and machine work; and that closer relationship be sought between the General Foremen's and the Tool Foremen's Associations, if possible a plan being worked out whereby the two organizations would meet during the same week.

F. A. DELANO ON SCIENTIFIC MANAGEMENT

F. A. Delano, president of the Chicago, Indianapolis & Louisville, in a brief address, referred to modern efficiency methods as a new application of old ideas. He gave the following definition of scientific management, which was developed by the members of the United States Commission on Industrial Relations from a number of definitions given before the commission by efficiency experts. Scientific management is essentially an effort to eliminate waste. More specifically, scientific management is that kind of management which aims at an accurate study, measurement and analysis of the various steps in any operation with a view to eliminating error, waste, false motions, etc. While scientific management does not carry with it any particular system of payment for work done, it does contemplate the essential necessity of complete cooperation between employer and employee and it has been generally assumed that this could not be obtained unless the employee shares with the employer in the benefits derived and thereby finds it to his interest to cooperate in attaining the results. With this object in view many and various systems have been devised, such as premium, bonus and others, but these are obviously only the methods adopted as an incentive to obtain the results, and are not to be confounded with the thing itself. Scientific management seeks to accomplish by improved methods what inventions of new machinery seek to accomplish, but the promoters of such methods, recognizing the necessity of cooperation, urge at all times the importance of giving the employee a share in the savings effected and not permitting the employer to take it all. In the best sense scientific management carries with it profit sharing by the employer with the employee; hence it is reasonable and proper that the employee should be consulted directly or through a representative shop committee in the fixing of price or wage schedules, bonuses, or premiums.

ENGINE HOUSE EFFICIENCY

The following is taken from a paper on this subject by W. W. Smith (C. & N. W.): In the report on engine house efficiency presented last year, the different phases of the subject were treated in a general way. The subject was continued so that new material could be added to stimulate discussion. The relation that good locomotive performance bears to railway earnings is now generally recognized, and hence new methods are constantly being devised to secure safety and efficiency of service. Strictly speaking, some of the items mentioned in this report do not come

under the head of engine house efficiency, but they have been included because of their important relation to the subject.

Engine Mileage.—An increase in engine mileage is equivalent to increasing the number of locomotives in through freight service. The operating department, by cooperating with the mechanical department, can do much to increase engine mileage. Trains are often too long on the road due to poor train despatching or overloaded engines; engines are delayed to and from the train yards and the engine house; they are delayed by yard forces not having trains made up; and often trains come in or are ordered out in bunches, so that the engine house organization cannot handle the engines in the way they could if the trains had been properly spaced.

Good judgment in shopping engines for repairs, and storing them during dull periods is an important item to be considered. While it is not economy to limit engines kept in service to a point that might delay freight, on the other hand it is uneconomical to have engines needlessly lying ready for service. In storing engines, those should be kept in service whose mileage comes nearest to entitling them to a shopping. If poorer engines are stored, the good ones are being worn out during the dull season.

There is undoubted economy in long runs for passenger engines, even though they are more conducive to engine failures. When locomotives in passenger service are on long runs, the running repairs are somewhat less per mile run and per car hauled, the oil and coal account is slightly less, and the cost of maintenance of the added number of engine houses is saved. In order to make long runs a success, locomotives must receive very careful attention at engine houses. By the use of stoker and oil fired engines, it is possible to make still longer runs.

Pooled or Assigned Power.—Whether it is best to pool power, or assign each engine to a regular crew, is an important consideration in engine house efficiency. When an engine is assigned to a regular crew, it is given more attention by the crew, there is less likely to be delay in getting away from the engine house, failures are less likely to occur, and the cost of maintenance is sure to be less. The assigned engine is always in better condition because the engine crew is continually reporting work, and following it up to see that it is done.

A system of regular assigned engines has been inaugurated on some of the divisions of the Chicago & North Western with gratifying results. With this system all engines in through freight service on one division must be of the same hauling capacity, and in equally good condition, so that they are suited for a fast freight one trip and a drag freight the next trip. The runs are pooled; that is, regular engines are not assigned to certain runs, but an engine crew with a regular engine will take any run that its turn on the board entitles it to. Of course with this system, more engines are required, as it is necessary to hold engines for the crew's rest, and one or two extra engines are required so that a regular crew can be furnished with a locomotive when the regular engine is held in for work.

Terminal Delay.—Out of each 24 hours the locomotive spends on an average, 6 hours in the engine house. The greater cost and earning power of recent locomotives makes it more necessary than ever to keep them in service. The question of turning engines promptly is one of system and supervision. It is not possible to reduce the time required for repairs to any great extent, so that any material saving effected must be in the handling. Ordinarily, the maximum period of delay occurs at the clinker pit, but where the piece-work system of cleaning and knocking fires has been introduced the delay has been cut down to a surprisingly low figure, and at the same time the cost has been greatly reduced.

In turning engines at terminals, the most valuable units of power should be given the preference; that is, when several different classes of engines are used in freight service. Also the ash pit tracks should be arranged so that engines not requiring washing out, or other heavy work, can be run around those requiring washing out. It often happens that engines are held in the engine house for work, or for other reasons, until they cool off, and thus considerable time is consumed in getting them steamed up again. Where a hot water fill-up line is provided, a considerable saving in time can be made by letting water out of the boiler and re-filling with fill-up water which is nearly at a boiling temperature. When it is the custom not to fire engines until they are ordered, this method is also of advantage, as it is sometimes difficult to get engines steamed up quickly with cold water.

The engine house foreman should always be in a position to quickly and accurately advise the transportation department when he expects engines to be ready for service. Then a definite prospective time should be given to the yardmaster two hours before the engine will be ready, from which time the engine should be ordered.

Engine Delays.—Delays in getting engines out of the house at the time for which they are ordered occur at times in spite of all efforts made to prevent them. When engines are ordered on prospective times, given before the engine is ready for service, initial delays may occasionally result, but this method actually saves about two hours delay to the engine. At busy terminals, where important trains are despatched, whenever possible an extra freight and an extra passenger engine should be fired and ready for service, so that in case of the unexpected happening, there will be an engine to fall back on. Delays sometimes result from the failure of either the day or night engine house foreman to notify the other concerning repairs that are left unfinished. When a running log book is maintained delays from this source are minimized.

Mileage Between Shoppings.—The aim of the engine house management should be to keep engines out of the shop as long as possible, having due regard to excessive lost motion and injury to track due to worn tires. It is probably best to compute locomotive costs on a ton mile basis so there will be a tendency on the part of master mechanics and others to keep engines in 100 per cent. efficiency as long as possible, and then when it proves impracticable for the engine house to further maintain them at their full hauling capacity, to shop them. As an average figure for all roads, freight locomotives do not make more than 40,000 miles between shoppings, and passenger engines not more than 80,000 to 100,000 miles. It costs on an average about $2,000 to give an engine a general overhauling so that a considerable saving is made by prolonging the time between shoppings. Occasional records of very high mileage have been made, and indicate what can be accomplished by care in construction, maintenance, and operation of locomotives.

Fuel Economy.—There are unlimited possibilities for saving fuel at the engine house. Cylinder and valves blowing, cylinder cocks and relief valves that do not seat, leaky whistle and pop valves, leaky boilers, steam leaks in the cab, improperly drafted front ends, bushed nozzles, etc., are all sources of waste that are caused by imperfect maintenance. The care of the boiler jacket and insulation and covering on steam pipes and cylinders, is also important, as the radiation from uncovered surfaces causes losses. Then there are direct losses of fuel at engine houses due to tanks being overloaded, to uneconomical methods of firing up engines, to engines popping off on the cinder pit track while waiting to have the fire cleaned, to engines fired too long before they are ordered, etc.

Engine Supplies.—There is spent annually in the United States between $4,000,000 and $5,000,000 for locomotive supplies alone, and nearly an additional million for labor in connection with the maintenance of this equipment. This means that the cost of upkeep per locomotive per year averages about $100. By close supervision at engine houses this high cost can be cut down. The list of tools carried should be cut down to the limit; then at each engine house there must be one or more good, reliable supplymen, or tool checkers to fill shortages, and see that damaged articles are repaired. Each engineman should have an individual tool box, which, together with the oil cans, should be removed from the engine at the end of the trip by

the supplyman. Engine cushions should be securely fastened to the seats, and suitable boxes or racks should be provided in the cab for lanterns, emergency signals, etc. In order that each fireman may have his own shovel, a suitable rack should be placed in the engine house to which shovels may be chained and locked.

Handling of Switch Engines.—The importance of effective switching service is often overlooked. When switch engines are delayed at the engine house, or are so poorly maintained that they cannot do effective work, the train service is correspondingly impaired. The engine house should make every effort to furnish switching power on time at the beginning of the day and when engines are in to have the fires cleaned. As an aid in doing this, the work at the cinder pit should be very closely supervised at noon and at midnight, when a number of engines are in at the same time to have the fires cleaned. Whenever possible a relief engine should be fired and ready for immediate service. Switch engines should be held in for inspection and repairs at stated intervals, and the grate rigging, etc., should be gone over carefully at this time, so there will be no occasion for a delay from that source when the fires are cleaned.

On several roads, at important terminals, a system of relief engines has been adopted. With this plan a relief crew is engaged in taking engines to and from the engine house and yard, and the regular yard engine crews do not come to the engine house with the engines. When an engine that is working needs to come to the engine house to have the fire cleaned or for work, the relief crew brings out a relief engine, and exchanges it for the other engine.

Co-operation.—The fundamental principle involved in getting good engine house service is the individual interest of every employee concerned, and the co-operation of all. Probably no other one thing can do quite as much to reduce the net earnings as friction or ill will between the operating and mechanical departments. The closer officials of the two departments get together, the better will be the results. The master mechanic or foreman should call up the the train despatcher the first thing in the morning, and help him to line up things, thereby heading off probable failures, and in return receiving valuable information for his department.

Then a friendly spirit of co-operation should exist between master mechanics and foremen of different divisions. It often happens that engines from one division run into the terminal of another division, and unless there is harmony between the men of the two divisions the best interests of the company must be sacrificed.

Terminal Facilities.—In order to efficiently handle the large engines of the Mallet, Mikado and Pacific types, now in general use, improved locomotive terminal facilities are absolutely necessary. The engine terminals used prior to the introduction of the heavy power are now entirely inadequate. The importance of up to date terminals has been quite generally recognized, as is shown by the care that has been taken in the design and construction of recent terminals.

Maintenance Costs.—Locomotive maintenance costs depend largely on the facilities provided and the cost and quality of the labor to be had. Then when the work is more liberal and thorough the costs are correspondingly increased. Of course large engines are more costly to maintain than smaller ones, and certain types and designs are more troublesome to keep up than others. For that reason it is uneconomical to run large engines on runs that can be handled by lighter power. Locomotive maintenance costs continue to increase, but when we make allowance for the increase in wages, the increased cost of material, and the added complexity of the modern locomotive, the cost of repairs per unit of work has been actually decreased. The practice of standardizing many parts of the locomotive, particularly those requiring frequent repairs or renewal, is general, and results in reduced maintenance costs. When parts and castings are arranged to be used either right or left the costs are still further reduced. Then, as far as possible, all parts should be so constructed and placed that they can be readily removed and replaced; otherwise repairs will be far more expensive than they would have been had the parts been more accessible.

As a further means of keeping down costs, all important engine houses should be furnished with an ample supply of spare parts, such as air pumps, lubricators, injectors, bell ringers, etc., which should be used to replace defective apparatus, whenever it will take less time to exchange than to repair. As a general proposition repairs to such accessories can be made to the best advantage at the shop, where special tools and machinist specialties are available.

Locomotive Inspection.—Rapid and accurate locomotive inspection is a matter of the greatest importance from a maintenance standpoint. Where the most satisfactory results are attained, inspection is made by a force of special inspectors who have been trained to inspect certain parts of the engine. This practice is followed at some of the important division points on the Pennsylvania Railroad.

DISCUSSION

W. F. Lauer, of the Illinois Central, stated that the greatest objection to assigned engines comes from the transportation department. On the Illinois Central the average time at terminals is less with assigned than with pooled. Engines and assigning power has reduced repair expenses and the number of mechanics required in engine houses. The consensus of opinion was against pooling. Mention was made of the advantage of a cold water line in engine houses to fill tenders before leaving and thus avoid delay if work is late on the engine. One member considered terminal delays mainly due to lack of organization. Mr. Smith stated that many engine failures could be prevented by careful study of failed parts, by proper discipline, and by periodical examinations and tests. One member claimed that most engine failures were due to lack of proper organization and inspection. Mr. Smith laid stress on the value of shifting shop and engine house men to give them all around training.

J. S. Sheafe, of the Baltimore & Ohio, made a brief address on the relationship of the general foreman to shop efficiency. An account of the Thursday and Friday sessions of this convention will appear in next week's issue.

RAILWAY EXTENSION IN CHINA.—The head office of the Chinese Eastern has received permission to begin the construction of a branch line from Pervaya Retchka (First River) to Churkin on the southern side of the Golden Horn Bay at Vladivostok. The line will be ten versts (6.7 miles) long and will include a tunnel 2,400 ft. in length. The total cost of construction will be $1,731,000, of which $250,000 is allotted for this year. The work will be finished in 1916.

RAILWAY PROGRESS IN THE CAUCASUS.—Last year was one of comparative activity in railway construction work in the Caucasus. The Armavir-Maikop-Tuapse Railroad is nearly completed and will soon be opened to traffic. The Kars-Sarikamish branch of the Transcaucasian State Railways was completed and opened to traffic toward the end of 1913. Surveys on the Sarikamish-Karaurgan section are in progress and the extension line will soon be commenced. Preliminary and survey work on the Black Sea Railroad was completed and the work of building the line will also soon commence. This road will extend south from Tuapse and it has been decided to have it join the Poti-Samtredi branch of the Transcaucasian State Railways at Kvaloni. The distance from Tuapse to Kvaloni is 213 miles. Progress was made on the Kakheti Railroad from Tiflis to Signakh and it is proposed to extend this line to Baku. The Djulfa-Tabriz Railway was begun and by the close of the year rails were laid for 8½ miles in Persian territory. The Vladikavkaz Railway completed two branch lines from Ekaterinodar in 1913, one to Yeisk and the other to Akhtari, both on the Sea of Azof; and a line from Krimskaya to Bataisk, near Rostoff-on-Don.

The Interstate Commerce Commission's Report on the New Haven

An Abstract of the Report with the Commerce Commission's Language Preserved, In So Far as Possible

In the present proceedings the commission has inquired into the financial affairs of the entire New Haven system. Since the former investigation there has been a change in the executive officers of the New Haven system. In justice to the present management, it is but fair to say that its chief executive officer and his special council have cooperated with the commission and rendered it substantial assistance throughout this investigation. The witnesses, other than the accountants for the commission, were in the main hostile, and with few exceptions their testimony was unwillingly given.

The result of our research into the financial workings of the former management of the New Haven system has been to disclose one of the most glaring instances of maladministration revealed in all the history of American railroading. In the course of the investigation many instances were uncovered of violation of the laws of different states. As these were not understood to be pertinent to our inquiry under the senate resolution we did not follow them into their details. As pointing to violations of state laws, we have turned over the evidence concerning local occurrences in New York City to the district attorney for the proper district, and the testimony relating to irregularities in Massachusets and Rhode Island have been laid before the proper authorities of those states. The commission has also furnished the Department of Justice with a complete record of the testimony.

The difficulties under which this railroad system has labored in the past are internal and wholly due to its own mismanagement. Its troubles have not arisen because of regulation by governmental authority. Its greatest losses and most costly blunders were made in attempting to circumvent governmental regulation and to extend its domination beyond the limits fixed by law.

The subject matter of this inquiry relates to the financial operation of a railroad system which, on June 30, 1913, had a total capitalization of approximately $93,000,000, of which $79,000,000 was stock and $14,000,000 bonds. In the ten years from June 30, 1903, this capitalization was increased from $93,000,000 to $417,000,000, exclusive of stock premiums, or an increase of $324,000,000. Of this increase approximately $120,000,000 was devoted to its railroad property and was expended for betterments and equipment. This leaves the sum of $204,000,000, which was expended for operations outside of its railroad sphere. Through the expenditure of this sum this railroad system has practically monopolized the freight and passenger business in five of the states of the Union. It has acquired a monopoly of competing steamship lines and trolley systems in the section which it serves. The financial operations necessary for these acquisitions, and the losses which they have entailed, have been skilfully concealed by the juggling of money and securities from one subsidiary corporation to another.

SIGNIFICANT INCIDENTS

Marked features and significant incidents in the loose, extravagant, and improvident administration of the finances of the New Haven as shown in this investigation are the Boston & Maine despoilment; the iniquity of the Westchester acquisition; the double price paid for the Rhode Island trolleys; the recklessness in the purchase of Connecticut and Massachusetts trolleys at prices exorbitantly in excess of their market value; the unwarranted expenditure of large amounts in "educating public opinion"; the disposition, without knowledge of the directors, of hundreds of thousands of dollars for influencing public sentiment; the habitual payment of unitemized vouchers without any clear specification of details; the confusing inter-relation of the principal company and its subsidiaries and consequent complication of accounts; the practice of financial legerdemain in issuing large blocks of New Haven stock for notes of the New England Navigation Company, and manipulating these securities back and forth; fictitious sales of New Haven stock to friendly parties with the design of boosting the stock and unloading on the public at the higher "market price"; the unlawful diversion of separate funds to political organizations; the scattering of retainers to attorneys of five states, who rendered no itemized bills for services and who conducted no litigation to which the railroad was a party; extensive use of a paid lobby in matters as to which the directors claim to have no information; the attempt to control utterances of the press by subsidizing reporters; payment of money and the profligate issue of free passes to legislators and their friends; the investment of $400,000 in securities of a New England newspaper; the regular employment of political bosses in Rhode Island and other states, not for the purpose of having them perform any service, but to prevent them, as Mr. Mellen expressed it, from "becoming active on the other side"; the retention by John L. Billard of more than $2,700,000 in a transaction in which he represented the New Haven and into which he invested not a dollar; the inability of Oakleigh Thorne to account for $1,032,000 of the funds of the New Haven intrusted to him in carrying cut the Westchester proposition; the story of Mr. Mellen as to the distribution of $1,200,000 for corrupt purposes in bringing about amendments of the Westchester and Port Chester franchises; the domination of all the affairs of this railroad by Mr. Morgan and Mr. Mellen and the absolute subordination of other members of the board of directors to the will of these two; the unwarranted increase of the New Haven liabilities from $93,000,000 in 1903 to $417,000,000 in 1913; the increase in floating notes from nothing in 1903 to approximately $40,000,000 in 1913; the indefensible standard of business ethics and the absence of financial acumen displayed by eminent financiers in directing the destinies of this railroad in its attempt to establish a monopoly of the transportation of New England. The combination of all these has resulted in the present deplorable situation in which the affairs of this railroad are involved.

NEW YORK, WESTCHESTER & BOSTON

The Westchester is a story of profligate waste of corporate funds. The enormous sum of $36,434,173 was expended for a road only 18.03 miles in extent, which is being operated at an annual loss of approximately $1,250,000. The Westchester acquisition was planned and executed by a special committee of the board, consisting of Directors Morgan, Rockefeller and Miller, with President Mellen as chairman. The full board was not taken into the confidence of these directors, who wanted the securities of the two proposed competing lines purchased, and no report was ever made by this committee placing the situation as they found it before the board.

In a letter of October 30, 1906, to C. S. Mellen, from the attorney, Francis Lynde Stetson, who was representing all the parties in the deal; namely, J. P. Morgan & Co., the Millbrook Company, Perry and Thorne, and the New York, New Haven & Hartford, there was the following language, which is significant as to the course the committee was pursuing:

> Referring to the conversation this morning, between yourself, Mr. Thorne and myself, it has occurred to me that it is possible that Mr. Thorne's purchase and even his payments may have to begin before he shall have ascertained the validity of the two principal properties which he has acquired, and that in the event of the development subsequently of their invalidity, it might be that the money spent would be money lost.

The report of this committee, however, was unanimously approved, ratified and confirmed at a meeting of the board

of November, 1907, at which the following directors were present: Mellen, Rockefeller, Morgan, Milner, Thayer, Brooker, Brush, Warner, Cheney, Miller, Skinner, Barney, Taft, Wittemore, Elton, Hemingway, Robertson, Robbins and Parker.

The New Haven had now acquired two franchises with roads parallel to each other and its own line, at a distance of only a few hundred yards apart. There was conflicting litigation pending, and matters were necessarily in a most unsatisfactory state and at a tangled stand-still. The solution of the difficulties was the further expenditure of $1,524,072.77. This was arranged by having the New Haven, on June 15, 1908, transfer to its subsidiary the New England Navigation Company, 8,000 shares of its stock at $150 per share, which the Navigation company in turn transferred to Charles S. Mellen, the president of both corporations, who conducted the negotiations. On March 5, 1909, an additional 1,495 shares of New Haven stock at $158 per share was in like manner placed in Mr. Mellen's possession, and certain sums of money were also advanced to him from time to time.

In explaining how these negotiations were conducted, Mr. Mellen testified that it was intended that one share of New Haven stock would be exchanged for three shares of Westchester stock. When New Haven stock was not immediately at hand, he issued to the messenger who brought the Westchester stock a duebill, which was in terms an order on himself to pay on demand to the bearer a specified number of shares of New Haven stock, or its equivalent in cash, at $150 per share with accrued dividends.

No comment is necessary to make clear to the mind the corrupt and unlawful nature of these transactions, and it would seem that the amount illegally expended can be recovered from Mr. Mellen and the directors who authorized it.

When the details of this acquisition were exposed in this investigation it was urged in explanation that by reason of the heavy terminal charges exacted from the New Haven on passengers delivered at the Grand Central station, it was very desirable that the New Haven have another entrance into New York City, and that the Westchester provided such an entry. A very casual study, however, of the map of the Westchester and the New Haven lines into New York impeaches the reasonableness of any such explanation. The New Haven, over the lines of the Harlem River & Portchester, a route then owned by it, had an entrance into New York City via Second Avenue and Third Avenue elevated lines. The Westchester is not constructed to use the tracks of the Harlem River & Portchester from 174th street into New York via these elevated stations. The subway has been constructed as far as Westchester avenue, and is being extended to 180th street, where a transfer station will be established with the Westchester, the two being some 300 feet apart at this point. At 174th street, however, the subway is only two or three blocks removed from the Harlem River & Portchester. If the New Haven had wanted an entrance to New York City via the subway, it could have established a transfer station somewhere with this Harlem River line, just as it is preparing to do with the Westchester at 180th street. It should be noted here, however, that this subway line is to be extended through to Mt. Vernon, paralleling the Westchester to that point, and furnishing a through rapid service into New York City. Again, the Westchester has no feasible connection with the main line of the New Haven below New Rochelle, and it cannot relieve the New Haven of a larger part of its commuter traffic, on which the Grand Central terminal charges are so serious a burden, than could the Harlem River & Portchester.

RHODE ISLAND TROLLEYS

The purchase of the Rhode Island trolleys was another instance of Mellen's waste in acquiring properties that bring an annual deficit instead of a surplus, and constitute a liability instead of an asset in the New Haven system.

When the details had been worked out by Mr. Mellen for assuming this additional burden, the directors without question acquiesced. Mr. Mellen testified that in addition to the cost of the Rhode Island trolleys, the Connecticut trolleys represented a payment of about $10,000,000 more than their value.

The Rhode Island and Connecticut trolley ventures are further evidence of the prodigality in the expenditure of the money of the New Haven stockholders in carrying out an unlawful policy of transportation monopoly.

STEAMSHIP LINES

The New Haven from time to time had felt the competition from steamship lines. Restless of any limitation of this power, President Mellen proceeded to acquire the steamship lines and thereby stifle these interferences with the New Haven activities.

The Hartford & New York Transportation Company cost the New Haven $2,538,917; the Eastern Steamship Corporation, $4,200,000; the Merchants' & Miners', $5,774,500; the New Bedford, Marthas Vineyard & Pawtucket, $141,700; the New England Steamship Company, $12,100,000; the Maine Steamship, $17,300, or a total of $24,772,417. The testimony shows that the physical value of the properties acquired as a result of these outlays is something like $10,000,000. The New Haven advises that it has recently disposed of its holdings in the Merchants' & Miners' Transportation at a loss of $3,594,500.

When Mr. Mellen had obtained control of every boat line of any importance in New England he suddenly changed his attitude when the public discovered the real ownership. It was then he proposed and urged that they be disposed of, but in this was overridden by his board.

BOSTON & MAINE

Before the New Haven secured control of the Boston & Maine stockholders of the latter had realized substantial dividends for a period of more than fifty years. Its credit was high and its stock was in the year 1900 valued by the railroad commission of Massachusetts at $190 per share.

There is reason for belief that this railroad in the hands of its former management would have continued to pay dividends and serve its constituency of passengers and shippers with reasonable rates and adequate facilities. The New England Navigation bought 55,000 shares of stock of the Boston & Maine owned by the American Express Company, and other stock of the Boston & Maine was gathered in by the New England Navigation Company, acting on behalf of the New Haven, until the latter road had a controlling interest in the Boston & Maine. This move, disastrous as it was to prove to both roads, was illegal under the Massachusetts laws, and without doubt under the Federal Anti-Trust Law, but impolitic, unwise, illegal and disastrous as it was to prove, it was undertaken with the realization of the illegality of this control of the Boston & Maine stock. Then began a series of transfers, shifts and evasions by which it was made to appear that the New Haven had divested itself of the Boston & Maine stock, while all the time it was being retained in friendly hands and under the control of the New Haven.

It may be of interest to note the passage of a controlling number of shares of the Boston & Maine stock:

First, from the American Express Company and others to the New England Navigation Company.

Second, from the New England Navigation Company to John L. Billard, nominally.

Third, from John L. Billard to the National City Bank as collateral.

Fourth, from the National City Bank to the New Haven.

Fifth, from the New Haven to the New England Navigation Company.

Sixth, from the New England Navigation Company to the Boston Railroad Holding Company.

The management of the Boston & Maine by the New Haven was unwise. It began in illegality and in a lust for extended

monopoly, and has resulted in great depreciation and serious impairment of credit.

When the New Haven was ordered to sell its Boston & Maine stock it was transferred to John L. Billard, a coal merchant of Meriden, Conn., where he paid taxes on property listed at $30,000. The Navigation company took in payment $11,000,000 raised by Billard on a note on the National City Bank secured by the stock as collateral, and a note of Mr. Billard, unsecured, for $2,743,500.

The New Haven at once set in motion its agencies for influencing public opinion, which resulted in the incorporation of a bill in the Legislature of Massachusetts authorizing the creation of a company known as the Boston Railroad Holding Company. This company bought back the Boston & Maine stock at $150 per share, which resulted in Billard receiving credit for $2,748,700 more than he was charged originally for the stock.

It is quite evident that it was not the understanding of the board that Billard should receive a profit of $2,748,700 out of this transaction, but that at most he was to receive only a reasonable compensation, estimated at from $100,000 to $500,000. All the assets of the Billard company belong to the stockholders of the New Haven. All the money sunk in this operation belonged to the New Haven. A suit should be maintainable by the New Haven against Billard and all who have participated in this fraud upon stockholders.

MANIPULATION OF ACCOUNTS

Several transactions appear of record which show that by no stretch of imagination can the irregularity of recording be qualified as due to carelessness. In February, 1911, the New Haven bought 23,520½ shares of Rutland stock from the New York Central, giving in exchange therefor its check on the Farmers' Loan & Trust Company for $2,364,977. No entry can be found in the record of the New Haven company which reveals this transaction. The stock thus acquired was on the same day, with a check for $135,023, delivered to the New England Navigation Company in exchange for a note for $2,500,000. The fact of the recording of this transaction is that the sum paid to the New York Central for the stock shows as a cash advance to the New England Navigation Company.

PURCHASES WITHOUT BIDS

Purchases of cars and coal are two large expenditures that railroads make. The New Haven purchased cars almost exclusively from James B. Brady without competition and to the extent of some $37,000,000. Mr. Brady as a witness made no secret of his generosity to the officers with whom he did business. His methods were justified by him on the ground that the officers of the New Haven were old friends.

Locomotives were bought from a company in which a director of the New Haven was also a director. Many supplies obtained by the New Haven were from companies having directors who were also directors of the New Haven. Corporate economy is not practicable where gifts and obligations arising from friendship tend to obscure official duty.

INTERLOCKING DIRECTORATES

The practice of one man serving on many boards of directors cannot be too strongly condemned. The man who holds directors' positions in a dozen corporations may be thoroughly honest in his relations with each, but it is not practicable for him to give the stockholders of each corporation the full benefit of his ability and energy when, in truth, he can afford only a small fraction of his attention to each corporation. If he is not permitted to know of the real workings of the corporation and, when he serves on so many boards, that is in the nature of things impossible, the corporation gets an indorsement to which it is not entitled.

There are too many ornamental directors and too many who have such childlike faith in the man at the head that they are ready to indorse or approve anything he may do.

A director should be an active, not a passive, force. He should understand the affairs of the corporation to which he gives the prestige of his name, at least to the extent of knowing the integrity of its designs and the absence of law-breaking methods in its operation, and he should not accept positions which he cannot fill in this comprehensive way.

Through the control of voting strength resulting from stock ownership by other corporations, a few persons whose individual holdings were small in comparison with the volume of stock of the company were enabled to perpetuate their full control of the New Haven company.

While the Connecticut laws require the majority of the directors to be residents of that state, the selection of Connecticut directors depends entirely upon the choice of the controlling and dominating interests in the company. In a similar manner the control of other great corporations is maintained by means of interlocking directorates.

The handling of bank deposits and security sales of these corporations is massed in a few hands, carrying with them a power and domination over large amounts of banking capital as well as the control of great railroad systems. These and other evils as the result of interlocking directorates are now well recognized and known, and they have been emphasized by the disclosures of this investigation.

FUNDS TO BE RECOVERED ON BEHALF OF THE STOCKHOLDERS

From the facts developed in this investigation, it would seem that there is little question concerning the recovery of a substantial amount of the stockholders' money that has been wasted. Several items of this nature have already been suggested herein and will be briefly summarized:

Overpaid Perry and Thorne in commissions	$303,750.00
Illegally spent in obtaining Westchester franchise changes	1,524,072.77
In the Billard transaction	2,748,700.00

NOTE.—The money with which Billard acquired the 15,755 additional shares of common stock and 5,826 shares of preferred stock of the Boston & Maine Railroad Company was furnished by the New England Navigation Company. This stock was turned back to the Navigation Company for $3,370,082. It would seem that a suit by stockholders for the recovery of the profit, if any was made by Billard in the transactions involving these additional shares, could also be maintained.

If any expenditures were made in violation of the anti-trust laws of the United States, are not such expenditures *ultra vires*, and is it not the legal obligation of the directors to satisfy out of their own fortunes any loss which results to the company?

These are all pertinent questions in the light of the developments brought about by this investigation.

Only lawful expenditures are authorized.

All illegal disbursements are *ultra vires*.

Directors cannot without accountability deplete a corporate treasury in ventures which are in violation of the laws of the land.

DIRECTORS CONSCIOUSLY TRANSGRESSING ANTI-MONOPOLY LAWS

The evidence shows that in pursuance of the policy of transportation monopoly the New Haven purchased the Connecticut trolleys, the Rhode Islands trolleys, the Massachusetts trolleys, steamship lines, the Boston & Maine Railroad, and other means of transportation that were available and purchasable. That this plan was done in violation of the federal statute it seems quite clear, for competition was sought to be destroyed. That the directors were conscious they were proceeding along lines that were probably inhibited by law is evidenced by the testimony of Director Elton, that as each line was purchased some one would ask the question in the board of directors if it were not in violation of law, and that Mr. Robbins, general attorney for the New Haven, would state to the board that the New Haven charter permitted them to do anything.

It appears, therefore, that not only were these consolidations contrary to law, but these directors were cognizant of that fact,

and contented themselves with the advice of counsel that under the company's charter it could do anything it pleased.

THE QUESTION OF IMMUNITY IN SECURING EXPOSURE OF ABUSES

In the investigations the commission is required to make from time to time it has, in accordance with its usual custom, exercised due caution not to require the testimony of witnesses where immunity might result except when it is necessary in order to get at the truth. The purpose of the immunity statute, as the commission understands it, was to aid in the search for facts by removing the obstacle of witnesses refusing to testify on the ground of self-incrimination, and under the statute the commission has always endeavored to exercise a sound discretion in this regard. In carrying out the instructions of the Senate in this case the commission has therefore kept in mind the warning of the Department of Justice to carefully consider before placing a witness upon the stand the effect his testimony might have in the way of immunizing him from criminal prosecution. The commission has only used such witnesses as seemed necessary to fully answer the Senate's inquiry and has refrained from calling those witnesses whose evidence, while interesting, might be merely cumulative.

With respect to Mr. Mellen, former president of the New Haven system, it was the belief of the commission that his testimony was necessary in this investigation, and the result, in our opinion, fully justifies this position.

Evidence of wrongdoing such as was disclosed in this hearing is difficult to obtain. Men do not conduct such transactions in the open, but rather in secret and in the dark. Only those involved, as a rule, have direct information. So some of the evidence of necessity must come through participants.

The commission has proceeded upon the idea that it is better to expose wrongdoing, even if in doing so it would be necessary to use a few witnesses whose testimony might bring them immunity, than through fear of bestowing immunity on some, leave facts unknown and uncovered and thereby give immunity to all, not only as to prosecution, but to the stigma of exposure as well.

NEW HAVEN MONOPOLY CORRUPT

This investigation has demonstrated that the monopoly theory of those controlling the New Haven was unsound and mischievous in its effects. To achieve such monopoly meant the reckless and scandalous expenditure of money; it meant the attempt to control public opinion; corruption of government; the attempt to pervert the political and economic instincts of the people in insolent defiance of law. Through exposure of the methods of this monopoly the invisible government which has gone far in its efforts to dominate New England has been made visible. It has been clearly proven how public opinion was distorted; how officials who were needed and who could be bought were bought; how newspapers that could be subsidized were subsidized; how a college professor and publicists secretly accepted money from the New Haven while masking as a representative of a great American university and as the guardians of the interests of the people; how agencies of information to the public were prostituted wherever they could be prostituted in order to carry out a scheme of private transportation monopoly imperial in its scope.

DIRECTORS CRIMINALLY NEGLIGENT

It is inconceivable that these wrongs could have gone on without interference if the members of the board of directors had been true to the faith they owed the stockholders. A number of directors appear in many instances to have voted without knowledge and to have approved the expenditure of many millions without information. According to the testimony of some of the directors they merely approved what had been done by some committee or by some officer of the company. The directors' minutes reveal that it was largely a body for ratification and not authorization, as the law intended a board of directors should be. None of the directors would have been so careless in the handling of his own money as the evidence demonstrates they were in dealing with the money of other people. The directors actively or passively acquiesced in the efforts of the Mellen-Morgan-Rockefeller régime to extend the domination of this corporation over the whole transportation field in New England.

If these directors who were faithless to their stewardship were held responsible in the courts and at the bar of public opinion for the failure to do those things they should have done, the lesson to directors who do not direct would be very salutary.

Most of the directors of the New Haven accepted their responsibilities lightly. They failed to realize that their names gave confidence to the public and that their connection with the corporation led the public to invest. When these directors were negligent and serious losses resulted therefrom they were guilty of a grave dereliction of duty and a breach of trust that was morally wrong and criminal in its fruits.

Directors should be made individually liable to civil and criminal laws for the manner in which they discharge their trust. A corporation can be no better or worse than those who operate it. It should be just as grave a crime to plunder stockholders or the public through a railroad corporation as it is to personally rob an individual.

SUBSIDIARY CORPORATIONS CONDEMNED

It was found in the investigation of the New Haven system that there were 336 subsidiary corporations, and the books of the New Haven road proper reflect only a small part of the actual financial transactions of the railroad. Many of these subsidiary corporations served no purpose save an evil one. They were used to cover up transactions that would not bear scrutiny, and to keep from the eyes of public officials matters that were sought to be kept secret. The commission should have the power to examine not only the books, records, papers and correspondence of interstate carriers, but of subsidiary companies as well.

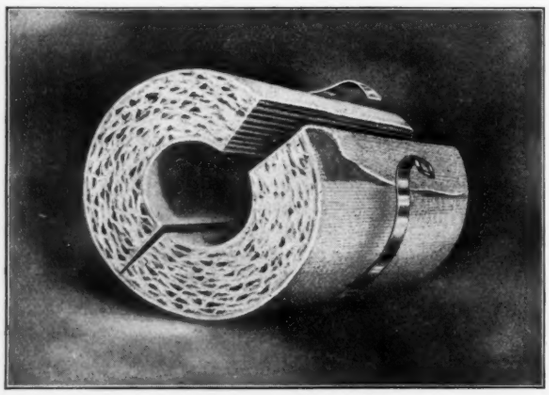
REMEDY IN PUBLIC CONSCIENCE AND LAWS

The insuring of honesty throughout the management of the great railroads of the country is a most important question before the people today, and only when through exposure of wrongdoing and an awakened public conscience coupled with effective laws this result is produced, may railroading be placed upon the high level that it should occupy. The revelations in this record make it essential for the welfare of the nation that the reckless and profligate financiering which has blighted this railroad system be ended, and until this is fully done there will be no assurance that the story of the New Haven will not be told again with the stockholders of some other railroad system as the victims.

DUST ON THE PARIS SUBWAY SYSTEMS.—Because of complaints received the Conseil d'Hygiène of Paris took in hand, about two years ago, some experiments as to the air on both the Métropolitain and the Nord-Sud and a report thereon has just been issued. This shows that the air on the former is much more vitiated than on the latter. The principal cause of the trouble is attributed to the rails. On the Métropolitain the wear is very pronounced, especially owing to braking, in the stations; but on the Nord-Sud the rails are, apparently, of harder steel, and the braking has had little effect. On the former line the brake-shoes are of cast-iron; on the latter they are faced with a tar-treated fabric, and, incidentally, the trains on the Nord-Sud stop much more smoothly and with less noise. The report refers to the fact that the floor of the coaches on the Métro has longitudinal strips along the upper surface, so cannot be swept clean, but on the Nord-Sud the floors are covered with a conglomerate material forming a uniform and non-slipping surface, which can be cleaned with sawdust. It is, therefore, proposed that in these matters the Métropolitain should follow the example of the Nord-Sud, also that the ballast in and near the stations be covered by tiles, so as to reduce the dust, and which can be swept.

STEAM PIPE COVERINGS

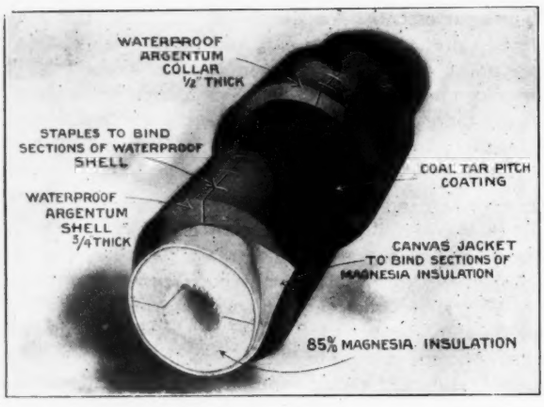
The Philip Carey Company, Cincinnati, Ohio, has placed on the market two new types of pipe covering, one for pipes used above ground, and another for underground installations. The first is termed the Carocel. It is made up of alternate layers of plain and corrugated pure asbestos paper, the corrugations measuring about ⅛ in. in depth. This construction has been used in order to provide as many dead air spaces as possible, which, of course, is one of the best insulating mediums to be had. With these layers pressed firmly together sufficient air space is left to give



Carey Carocel Sectional Pipe Covering

the necessary insulation and all chance of circulation is eliminated. The ends of the covering are so trimmed that all the air spaces are practically sealed. Another advantage is that there is no possibility of circulation around the pipe, thus preventing the opportunity for heat leakage at the point where the two halves come together. This insulation is of light weight, and yet firm enough to withstand the rough handling received in service. It is covered with pure asbestos fibre, and the sections are held together by brass bands, as shown in the illustration.

The underground insulation is known as the Carey Argentum-Magnesia sectional pipe covering. Its construction is clearly


WATERPROOF ARGENTUM COLLAR ½" THICK
STAPLES TO BIND SECTIONS OF WATERPROOF SHELL
COAL TAR PITCH COATING
WATERPROOF ARGENTUM SHELL ¾ THICK
CANVAS JACKET TO BIND SECTIONS OF MAGNESIA INSULATION
85% MAGNESIA INSULATION

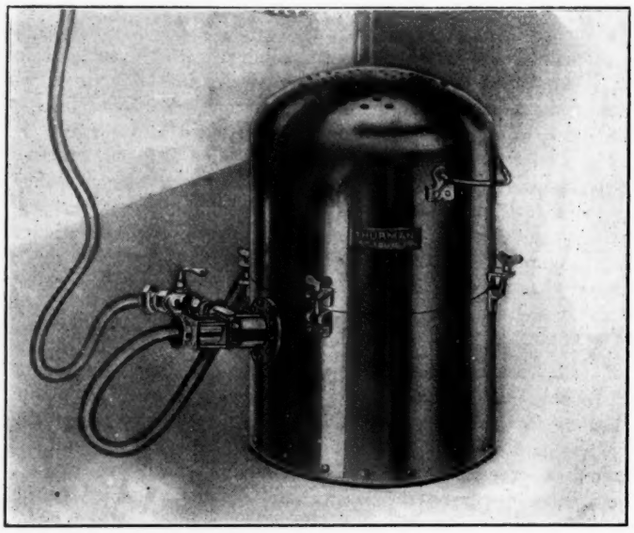
Carey Argentum-Magnesia Covering for Underground Pipes

shown in the illustration, being made up of the regular 85 per cent. magnesia covering, with the water-tight armor of Argentum applied over and thoroughly protecting the magnesia insulation. These Argentum shells are water-proof and strong enough to protect the insulation from injury, being made of a chemically treated wool felt. They are exceptionally tough and are furnished in sections 3 ft. long and ¾ in. thick. Collars 6 in. long and ½ in. thick, made of the same material, are furnished for each section to be applied over and seal the joints of butting Argentum shell sections. The purpose of this new type of insulation is to provide a water-tight insulation. For underground pipes the greatest trouble is had in the loss of heat through contact with water, which is very much greater than with contact with the air.

VACUUM CLEANER FOR PASSENGER CARS

A compressed air operated vacuum cleaner adapted to the cleaning of passenger cars is shown in the illustration. The equipment consists of an aspirator attached to a dust collector, and a ½ in. hose for connection to the source of compressed air supply. A 1 in. vacuum hose connects the tools with the aspirator. The complete outfit weighs about 35 lb., and is therefore easily portable.

The vacuum is produced in the aspirator by means of a small compressed air jet, about ⅛ in. in diameter. With 65 lb. air pressure the consumption is about 20 cubic feet of free air per minute, and the vacuum produced is equivalent to a 12 in. mercury column. With higher air pressure the vacuum may be considerably increased. In operating this machine the first part of the cleaning should be done by blowing the cinders and dust out of the ventilators and crevices with compressed air, the vacuum



Compressed Air Operated Vacuum Cleaner

tools not being effective where contact with the surface to be cleaned is impossible. After this is done the compressed air hose is attached to the apparatus, and the cleaning finished by the vacuum process.

This cleaner is in use on the Chicago & Alton, where it is claimed that one man can clean 14 standard railway plush seated coaches or chair cars per day. It is manufactured by the Thurman Vacuum Cleaner Company, St. Louis, Mo.

RAILWAY CONSTRUCTION IN SIAM.—Plans are now being made for the new station buildings for the Siamese Southern at Bangkok Noi which will be necessary for the increased traffic which is expected on the completion of the extension of the railway, which when completed will be about 813 miles long. The line is now open for traffic from Potchaburi to Prang, about 147 miles. A further extension of 41 miles to Koh Lak was expected to have been opened the first of June of this year. It is expected that the line as far as Singora will be opened for traffic in 1916. Construction was started in 1909 at three places, namely: Potchaburi Singora and Prang, and at that time it was hoped that the whole system would be ready for traffic in 1915.

Maintenance of Way Section

One of the obstacles which have retarded the adoption of concrete for railway building construction where appearances were an important consideration, as in stations, has been the difficulty of securing a paint which would adhere permanently to the concrete without undue discoloration. Several early attempts along this line proved unsatisfactory, for which various reasons have been assigned. To solve this problem indirectly bush hammering and other practices have been adopted to provide a pleasing untreated concrete surface. There are, however, occasions where a paint treatment is to be desired, and the discussion of this subject elsewhere in this issue should therefore be of general interest in showing that it is entirely possible to secure permanent and satisfactory results with certain kinds of paints.

The Painting of Concrete

The point raised by Mr. Crites in his discussion of Uneconomical Track Economy on another page in this issue is one realized too frequently only in the abstract, if at all, when retrenchment is under way. It is common knowledge that maintenance of way expenditures are reduced first and to the greatest extent because it is felt that the results of such action will not be evident at once, although it is generally realized that larger sums will have to be expended in the end. The effect of poor track in reducing train tonnage and thereby increasing the cost of operation is not so generally realized. Only a few years ago most railroad men gave little credit to such a theory and some refuse to accept it even at this late date. However, the experience of numerous roads has shown conclusively that the adoption of heavier rail and more ballast and a higher standard of maintenance have enabled the tonnage of trains to be increased without any change in grades or motive power. Thus, when an order is given to reduce maintenance of way expenditures to a point where existing track standards cannot be maintained, it is equivalent to arbitrarily inserting heavier grades, the result of which will be reflected either in decreased train loads or in more delays and overtime, in this way increasing expenses, the very thing which the officers are trying to avoid.

Track Maintenance and Tonnage

The three primary qualifications of a foreman in charge of any class of maintenance work are, his knowledge of the methods of properly performing the work, his ability to prepare the proper time rolls and other records, and his ability to handle the men in his gang. As a laborer in the gang he secured his knowledge of the methods of performing the work, while the supervisor instructs him in the manner of preparing his reports. Unfortunately, in most cases, he receives little or no instruction regarding the way to handle the men in his gang to secure the maximum amount of productive work from them. Regardless of the fact that the men selected for foremen probably possess considerable natural ability along this line, there is no question but that the more experienced supervisor can give them valuable assistance in this regard. Probably as many foremen fail because of the lack of this qualification as because of the absence of either of the other two. Further than this, many foremen are only partially successful in securing the greatest returns for the company because they do not know how to handle their men to the best advantage. The really successful and valuable foreman is the one who combines the ability to handle men with the other necessary qualifications. It is to the interest of the road that the efficiency of all foremen be brought to the highest practicable level, and for this reason this subject is of sufficient importance to justify the serious consideration of every supervisor. There is much of merit in what Mr. Schott, who is himself a section foreman, says in another column regarding this phase of the training of foremen.

Instructing Foremen in the Handling of Labor

One road recovered over $50,000 worth of material by increasing the distance between extra rail posts from one to two miles; another road reclaims 50 per cent. of all maintenance scrap collected other than rails and angle bars. Similar savings are, or can be, made in the distribution of new material and the collection of scrap on other roads. The maintenance of way department is directly interested in the handling of its material to insure that it is received when needed, that a sufficient but not a surplus stock is available, that obsolete material is not allowed to accumulate, that second-hand or scrap material is collected as soon as released, and that no material suitable for further use is disposed of as scrap. Different roads have attacked the various phases of this important problem in different ways and with varying degrees of success. A thorough discussion of this subject, with descriptions of methods which have been worked out or suggested, will be of value to those roads which have already given this subject attention, and of greater value to the lines on which this important problem has been neglected. To secure as complete a discussion as possible we are conducting a contest on "The Distribution of New Material and the Collection of Scrap," for which we solicit the co-operation of all who have given this subject serious consideration. To stimulate interest in this contest we will pay $25 and $15 for the two best papers received and our space rates for all other papers accepted and published. The award will be based on the practicability of the methods described and the completeness with which the subject is covered. All contributions should be sent to the Engineering Editor of the *Railway Age Gazette,* 608 South Dearborn street, Chicago, to be received not later than July 25.

Handling New and Scrap Material

One of the most important advantages of concrete as a construction material is the fact that local materials can be very largely employed, and it is this fact which has led to its rapidly increasing use for a wide variety of purposes on maintenance work. With its very general adoption for small as well as large work, there arises an increased necessity for the careful instruction of the supervisors and foremen regarding the proper selection and inspection of the sand, gravel and stone used as the aggregate. In general the cement is properly inspected and tested before being shipped to the work. On large work the materials composing the concrete are in most cases carefully tested, frequently by the testing department itself. On smaller jobs where the material is secured adjacent to the work this is not practicable. It is important, for this reason, that the supervisor or foreman selecting these materials should be instructed regarding the ordinary objectionable materials which should be avoided in concrete. For all ordinary purposes this instruction need not be elaborate or in detail, but if the injurious ingredients commonly encountered are called to the attention of the supervisor he will be able to reject materials now sometimes incorporated in the concrete. It is almost universally true that whenever a failure of concrete occurs the cement is blamed. Careful analyses of such failures have shown in so many instances that the cement

Inspection of Concrete Aggregates

is not at fault, that the prominent cement companies maintain special departments to investigate such complaints, and to ascertain the real difficulty. In a paper presented before the American Society for Testing Materials a couple of weeks ago, several instances were cited where studies of failures of concrete showed the difficulty to rest primarily with the sand and gravel, and often with the water. One remedy is to select the aggregate from a few locations of known quality. A better way is to instruct the supervisors and foremen regarding the deleterious materials which may reasonably be expected.

The Magnitude of Railway Construction Work

There is an old saying that distance lends enchantment to the view. This applies equally well to such sordid matters as railway construction. Railway men close to their work are apt to lose sight of the real magnitude of many phases of the work which the roads are capable of doing, and are actually doing. The magnitude of the problems involved in the construction of the Panama Canal has been heralded around the world. While not intending to detract in the least from the credit due for this work, a few comparisons may give the railway man a higher impression of his own work. The last issue of the *Canal Record* gives the total wet and dry excavation since the United States assumed control of the Canal Zone as 220,826,656 cu. yd., spread over an interval of ten years, or an average of 22,082,657 cu. yd. per year. The highest individual year's record was 37,116,735 cu. yd. in 1908. By way of contrast a statement was published in the daily issue of the *Railway Age Gazette* of March 19, showing that the Chicago, Milwaukee & St. Paul alone moved 23,750,200 cu. yd. of material in 1912, and 24,553,411 cu. yd. in 1913. During those same years 30,269,349 and 27,177,960 cu. yd., respectively, were moved on the Canal Zone. In 1912 the St. Paul deposited 246,823 cu. yd. of concrete, and in 1913 316,989, or a total in the two years of 563,812 cu. yd. During the same years 1,040,158 and 337,419 cu. yd. of concrete, respectively, were placed in the Gatun, Pedro Miguel and Mira Flores locks. Thus the St. Paul alone handled over 75 per cent. as much earth work, and almost 45 per cent. as much concrete during those two years as the Isthmian Canal Commission, with comparatively little notoriety or advertisement. Furthermore, the railroad work was scattered over a wide area, making it more difficult to handle. Other railroads, including the Northern Pacific, the Erie and the Lackawanna, have made similar records in recent years. Such comparisons as this show the magnitude of the problems encountered from time to time in the regular railway routine.

RUSH THE MAINTENANCE WORK

UP to this time maintenance of way expenditures have been very seriously curtailed this year. However, all indications now point to a very material increase in traffic within the next two months, especially on the granger roads. This will result in an increased burden on the track which it is none too well prepared to carry. The conclusion is evident. Every effort should be exercised for the next 60 days towards getting the track into the best possible condition to carry a heavy traffic with the minimum delay to trains. To do this attention should now be concentrated on the tracks and structures directly concerned with the movement of trains. Work, such as the rebuilding of fences, should be deferred in favor of the laying of rail, the surfacing of track, and the necessary renewal of bridges. Then when the traffic is heaviest, and the resulting interference with maintenance forces the greatest, this deferred work can be resumed. In this way the track and structures will be brought up to their proper condition at the earliest date, and it will also be possible to do this work more economically now than later, because of the smaller amount of interferences caused by traffic.

More important than this, however, these forces will in turn cause less interference with traffic if work is handled in this way. The main business of a railway is to provide transportation. In times of heavy traffic when the public demands the maximum amount of service, all departments should co-operate with the operating department in handling the peak load. The maintenance department can assist very materially in getting trains over the road by maintaining the tracks in such condition that the number of derailments will be reduced to the minimum, and by creating the smallest practicable number of slow orders and other delays, all of which result in still further increasing the congestion.

Any work put on the track now will tend to reduce the number of derailments later. It is common knowledge that with each rapid increase in traffic the number of derailments increases faster than the traffic, indicating that the track is unable to keep up with the increased demands made on it. Every derailment tends to further increase congestion, and is therefore cumulative, the resultant congestion being in most cases of much greater consequence than the mere cost of the damage to the track and equipment.

This warning applies to yard, as well as to main tracks. In times of heavy traffic it is in the yards that the most serious congestion usually occurs. Under such conditions the taking of a track out of service not only decreases the capacity of a yard by that amount, but tends to disorganize the operation of the entire yard at a time when smooth running is most essential. Now is the time to prepare for the expected increase in traffic, and give the operating department a chance.

THE SYSTEMATIC TRAINING OF SUPERVISORS

THE practice of most roads is to recruit their supervisors from the ranks of the foremen. As a result, on those roads on which there now exists the greatest scarcity of high grade foremen, a shortage of material from which to create supervisors is also beginning to be felt. Numerous attempts have been made from time to time to recruit supervisors from technically trained college graduates, but for various reasons most of these plans have failed. As described in another column, the Pennsylvania has had in operation for many years a definite system whereby technically trained men are secured for supervisors, and there is no prospect of a shortage of material from which to recruit these supervisors, as it has at all times a sufficient number of men to fill its requirements for some time in advance.

It is not the intention at this time to discuss the relative merits and shortcomings of supervisors recruited from track foremen and technically trained men, except to state that if the course provided for the college graduate after he leaves school is so arranged that he can secure the requisite practical experience he should be the more valuable man because of his technical training. The difficulty with the various track apprentice systems which have been tried has been that they were in most cases local experiments of short duration, and with only a hazy and indefinite future for the student. On the Pennsylvania this practice has been so firmly established, and the methods of promotion so clearly outlined that a man knows that if he makes good his future is assured.

While it might seem at first glance that such a course of training would involve a considerable outlay for unproductive work while the student is in training, these men are all employed in work for which other men would be required if this course of training did not exist, and in fact the salaries in the classified service are somewhat lower than for similar positions in the unclassified service where there is no similar chance for advancement.

The success of the Pennsylvania's system has resulted from a carefully outlined plan of operation which has been in force a sufficient length of time to enable it to become firmly established. The practical results are indicated not only by the very large number of the Pennsylvania's officers who have risen through the maintenance of way department, but also by the many responsible officers of other roads who have received this same training. While this somewhat elaborate plan would not be practicable in all of its details on many other roads operating under other conditions, the underlying principles are sound, and are capable of application elsewhere. Three elements are necessary, a definite system, a supply of men and a sufficient reward.

The Magnolia Cut-off of the Baltimore & Ohio

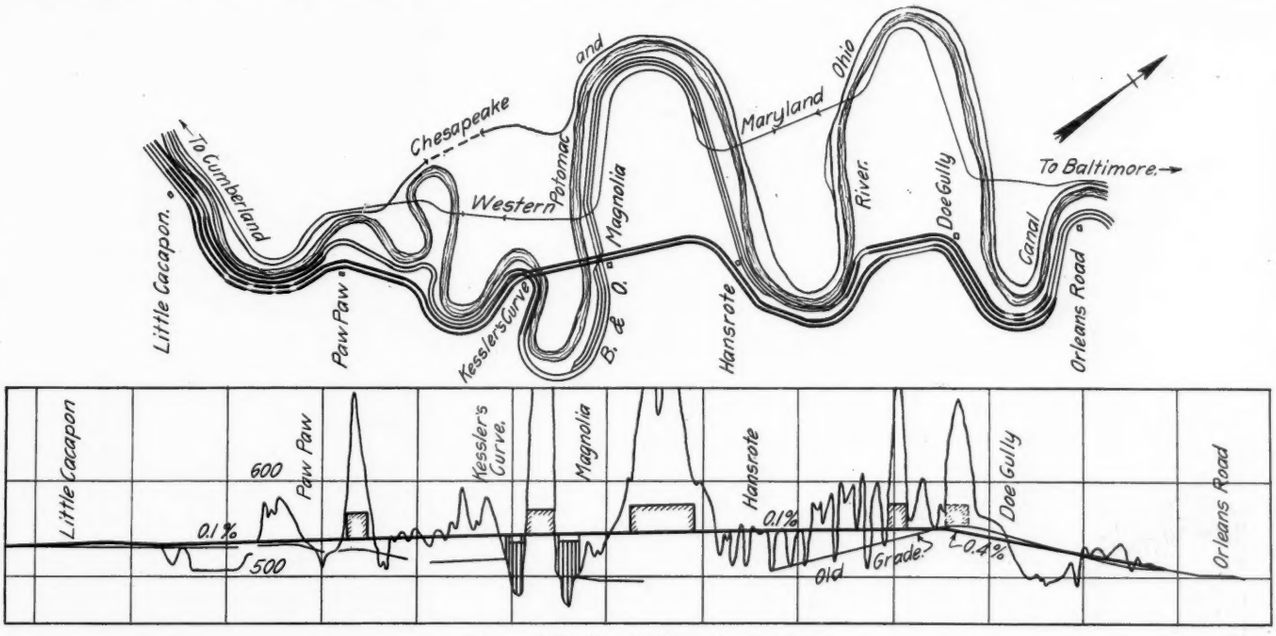
This Road Is Building a 12-Mile Line Involving Very Heavy Work, and Costing Approximately $6,000,000

The Baltimore & Ohio is now building two additional tracks between Orleans Road, W. Va., and Little Cacapon, a distance of 12 miles, which involves some of the heaviest railway construction work now under way in this country. This line is known locally as the Magnolia Cut-off, and involves moving over 3,200,000 cu. yd. of excavation, over 90 per cent. of which is rock; the driving of four double-track tunnels with a combined length of 7,225 ft.; the construction of two crossings over the Potomac river, with a total length of 2,054 ft., and the building of 5,200 lineal feet of concrete retaining walls. This line is estimated to cost over $6,000,000, or $500,000 per mile, and will eliminate 5.95 miles of distance, and 877 deg. of curvature. It will also reduce the maximum grade against eastbound traffic from 0.5 per cent. to 0.1 per cent., eliminating a helper grade 2.8 miles long, and releasing two pusher engines.

This cut-off is located on the east end of the Cumberland division, Little Cacapon being 16.7 miles east of Patterson Creek, where the double-track line from Cincinnati and the West Virginia coal fields unites with that from Pittsburgh and Chicago. There are now three tracks from Patterson Creek to Little Cacapon, and also from Orleans Road east 25.4 miles to Cherry Run. At Cumbo yard, a short distance east of Cherry Run, a considerable amount of coal and other traffic is turned over to the Cumberland Valley road. The line between Patterson Creek and Cumbo yard carries a very heavy traffic and the two-track section between Little Cacapon and Orleans Road, with its pusher grade, has been the cause of serious congestion.

The two new tracks will be used for eastbound traffic, while the present double-track line will be used for westbound traffic, thus providing a four-track line between Little Cacapon and Orleans Road. Except at Doe Gully the old line closely follows the southerly bank of the Potomac river, and has a large amount of curvature with a maximum of 9 deg. of Kessler's curve. The maximum grade eastbound on the present line is 0.5 per cent., and westbound 0.55 per cent., leading up to the present Doe Gully tunnel in both cases. On the new line the maximum grade eastbound is established at 0.1 per cent., while the maximum westbound on the old line is being reduced to 0.4 per cent. by lowering the east end of Doe Gully cut about 12 ft. The maximum curvature on the new line is 5 deg.

Starting from a connection with the old line a short distance west of Orleans Road, the new line ascends on a 0.4 per cent. grade to the west end of the present Doe Gully tunnel, and is being built as a four-track road to reduce the existing 0.55 per cent. grade westbound. At Doe Gully tunnel the new line leaves the old and extends west generally parallel to it, but on a 0.1 per cent. descending grade, for two miles to Hansrote, and is located on a bench adjacent to, but considerably above the operated tracks. At Hansrote the new line turns abruptly into the hill and after passing through Stuart tunnel crosses the present line and the Potomac river, passes through Graham tunnel, and again crosses over the river and the existing line. It then continues parallel to the present road for over a mile, but on a bench about 40 ft. above it. It passes through the southerly limits of the town of Paw Paw, and joins the old line at Little Cacapon, the 0.1 per cent. grade being almost continuous from the summit at Doe Gully.



Map and Profile of Magnolia Cut-Off

DOE GULLY CUT

Starting from Orleans Road the first work of special interest is at Doe Gully. Here a double-track tunnel is being replaced by a four-track open cut with a maximum depth on center line of 195 ft., and requiring the removal of 1,350,000 cu. yd. of material, nearly all of which is rock, lying in strata tilted sharply on end. In addition to the amount and character of the material to be removed, the excavation of this cut was complicated by the necessity of keeping the present double-track tunnel in continuous service. As shown in one of the photographs, the material on the west side of the cut and over the tunnel was excavated by

steam shovels in the regular manner to within 10 ft. of the roof of the tunnel. A vertical ledge 16 ft. wide was then left west of the west wall, and the west half of the cut was taken out approximately to grade. A temporary double-track line was then laid through this cut for emergency use in case the tunnel should be blocked during its removal. A small steam shovel is now engaged in removing the remaining material from above the tunnel, after which it will be dismantled and the cut widened on the east. Five steam shovels

Looking East at West Portal of Old Doe Gully Tunnel

have been employed in this cut, while as many as 22 have been working at one time on the entire cut-off.

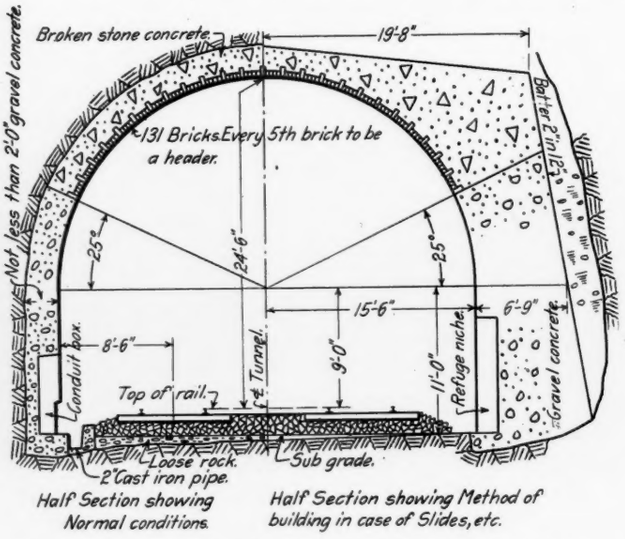
Because of the depth of the cut and the character of the material the slope on the west side has been benched at intervals of 50 ft. vertically, while the opposite slope will be treated in the same manner after the tunnel has been removed. These benches are designed to afford drainage and to prevent slides, and have been built on grades of 3, 2 and 1½ per cent. on the upper, middle and lower levels respectively. The material from these benches was wasted at the elevation of the benches at the ends of the cut.

Immediately west of Doe Gully cut the new line goes through a point by means of a tunnel 1,025 ft. long, known

Looking East Along Bench Towards Randolph Tunnel. Old Tracks in the Foreground

as Randolph tunnel, the four tunnels on this line being named after chief engineers of the road. This tunnel is located on a 4 deg. curve. Here a top heading 9 ft. by 16 ft. was first driven. Following this a Model 20 Marion air-operated shovel widened the heading to the full arch section. The bench was then removed by a large shovel.

The arch was lined with timber as the excavation progressed, and this was replaced with the permanent concrete lining as soon as the steam shovels had completed their work. It was first planned to deposit the concrete by means of compressed air with a mixer at one end and this method was tried, but after encountering considerable difficulty because of the pipe line clogging with the coarse crushed stone aggregate used, and the length of the conveying line, this method was abandoned. The standard lining consists of concrete up to the 25 deg. line, faced with one course of brick above this point. To secure a bond with the concrete every fifth brick

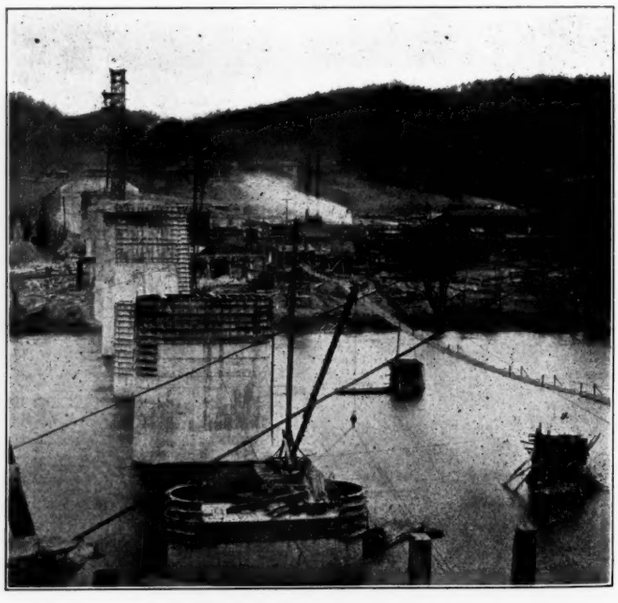


Section of Standard Double Track Tunnel with Concrete Lining

was made a header. Blaw steel forms were used. Refuge niches were inserted on each side at intervals of 100 ft. and cable and switch boxes were placed 300 ft. apart.

BENCH WORK NEAR HANSROTE

One of the most interesting portions of the work is that from Randolph tunnel southerly 1½ miles to Hansrote. Be-



Looking East Over Magnolia Bridge

tween these points the new line is closely adjacent to the existing line and on a bench above it. Because of this close proximity it was decided to handle this section by force account, and over 400,000 cu. yd. of rock is being removed in this manner. Most of this material is being removed by steam shovels, excavating benches not to exceed 8 ft. in

depth and it is wasted in ravines at the level of the different lifts. A considerable amount is also being placed on the river side of the present tracks by station men to permit these tracks to be thrown out at certain locations, in this way reducing the maximum degree of curvature from 5 deg. to 3 deg.

To guard against the danger of accidents to trains on the operated line, an operator is stationed on this work who is in constant communication with the despatcher, and no shots are fired without first learning the location of trains. Flagmen are also sent out in each direction in advance of each shot. To guard against any danger of blocking the main tracks by excessive or poorly placed shots, four powder inspectors are stationed on this portion of the work, one of whom personally supervises the loading and firing of each charge.

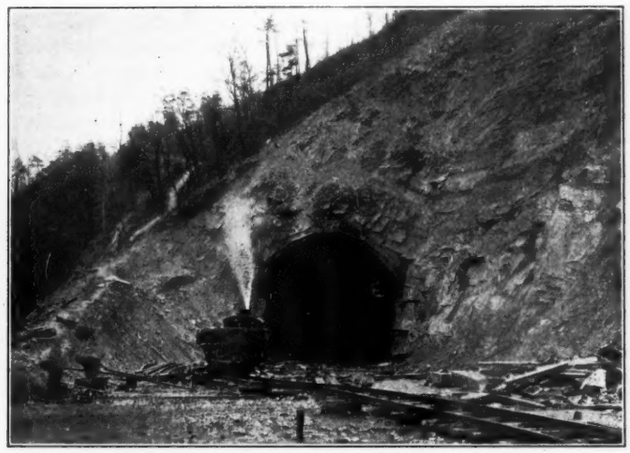
Traveller Used for Constructing Retaining Wall East of Paw Paw

STUART TUNNEL

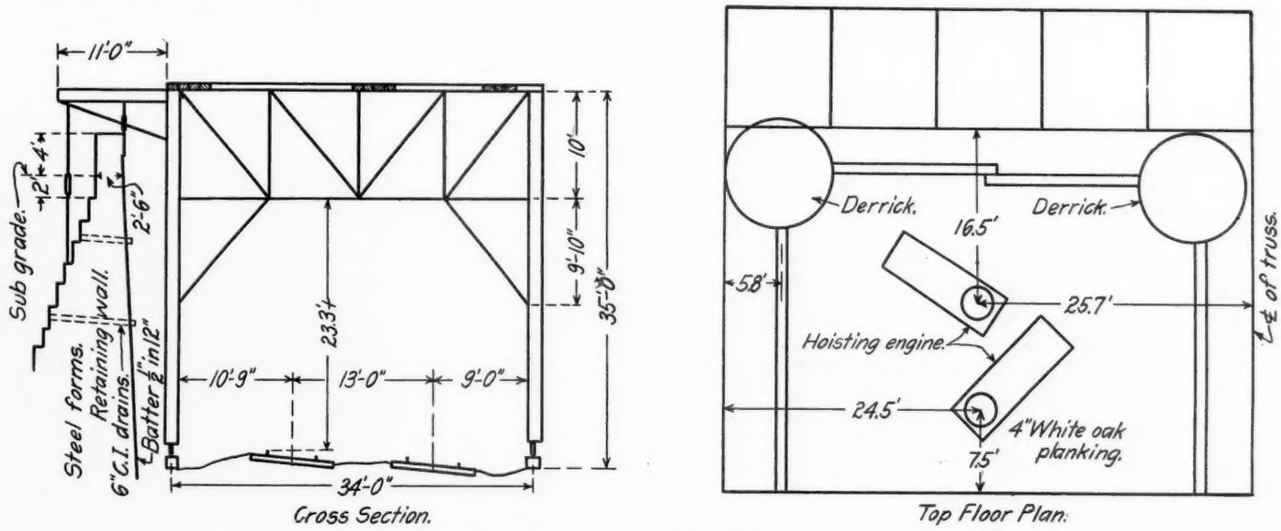
At Hansrote the new line leaves the old and turns abruptly into the hill, crossing the divide through Stuart tunnel 3,600 ft. long. The east approach to this tunnel required the removal of 205,000 cu. yd. of rock. About 90,000 cu. yd. of similar material was removed from the west approach. At the latter point considerable difficulty has also been encountered in establishing the portal because of the sharply inclined and badly broken strata. This tunnel is on tangent except for 371 ft. of spiral within the east portal.

This tunnel was driven from two shafts 117 and 40 ft. deep, and also from the west portal, the east approach cut not being completed in time to enable a heading to be driven from the east portal. As in the Randolph tunnel 9 ft. by 16 ft. center headings were first driven, working in this instance from five points. These headings were widened to full section by hand except for the first 1,000 ft. in from the west heading, where a small Model 20 Marion shovel was used. With this shovel it was possible to widen and timber 60 to 70 lineal feet of the arch section per week as compared with 45 ft. by hand. The shovel also removed 6 ft. of the bench at the same time to secure the necessary working clearance. The bench was then taken out with large shovels.

Because of the difficulty encountered in establishing the portal at the west end and the uncertain character of the material at the east portal, the center heading was driven from the shaft to within 72 ft. of the east portal, at which point it opened into two wall plate drifts. The entire arch section was then removed for 30 ft., after which the wall plate drifts alone were driven leaving the center support for the roof for 42 ft. in from the portal until the portal was turned.



The West Portal of Paw Paw Tunnel



Plan and Cross Section of Traveller Used in the Construction of the Concrete Retaining Wall

Both steel and timber centers were used in this tunnel. The steel centers were used in those sections of the tunnel where especially bad material was encountered while the wooden centers were used elsewhere.

THE RIVER CROSSINGS

A short distance west of Stuart tunnel the new line crosses the old at Magnolia station, continues across the Potomac river, passes through a point in a tunnel 1,600 ft. long, and

again crosses the river and the operated line, all in a distance slightly over one-half mile. The crossing at Magnolia consists of six 100 ft., three 80 ft. and two 75 ft. deck plate girder spans on concrete piers, with the new grade 50 ft. above the old line and 60 ft. above the water. The crossing at Kessler's curve consists of four 100 ft. and six 75 ft. deck plate girder spans with three skew girder spans over the old line, with a combined length of 202 ft. 6 in. Both structures are designed for Cooper's E 60 loading.

The piers for both structures are founded on rock about 5 ft. below the river bed. One of the accompanying views shows clearly the different steps in their construction. About 23,000 cu. yd. of concrete was required at these two crossings. As far as possible the concrete at each structure was deposited by means of a tower located either on the bank or at the first river pier where material could be delivered to it by a derrick. The tower at the west crossing was 185 ft. high. Concrete was deposited by air in the upper portion of a few of the piers at each crossing above the reach of the tower, and one or two piers were completed by depositing concrete directly with a derrick.

Graham tunnel, located between the two bridges, differed from those previously described primarily in that it passed through a stable rock instead of the broken, rapidly weathering material found at the Stuart and Randolph tunnels. It was driven by the same methods employed at the other

Constructing the Retaining Wall West of Paw Paw

points, and it is planned to place the concrete lining with an air mixer.

THE CONCRETE RETAINING WALLS

From Kessler's curve west for a mile the new line is again closely parallel to the old, and on a bench about 40 ft. above it. Over 80,000 yd. of rock is being removed along this bench at elevations varying from 40 to 100 ft. above the present track. This material is being handled by force account under methods similar to those employed east of Hansrote. To prevent slides and other difficulties all of the high side-hill cuts are being benched.

At the west end of this section it was necessary to construct 1,900 lineal feet of concrete retaining wall between the two lines. This wall is of gravity section non-reinforced, and with a maximum height above the footing of 31 ft. The elevation of the top of footing is established at 3 ft. below the top of rail of the lower line. The construction of this footing has involved considerable difficult work, as in some cases it has been necessary to go as much as 14 ft. below the elevation of the top of footing to secure a proper foundation, while in other cases it has been necessary to remove a 40 ft. rock face to secure sufficient room. The top of the wall is 4 ft. above the elevation of sub-grade of the new line.

This wall requires the placing of 22,000 cu. yd. of concrete which is being deposited by means of a movable traveler spanning the two operated main tracks. This traveller is of steel construction, with a horizontal clearance of 32 ft. 9 in. and a minimum vertical clearance of 23 ft. 3 in. above the high rail on curves.

Two derricks with 50 ft. booms, and two boilers and hoisting engines are placed on the upper platform. In this way all excavation for the wall footings and the depositing of the concrete are handled by the derrick without interfering with the main track, and without any material crossing the tracks at grade. The forward derrick handles the excavation ahead of the wall, while the other one deposits the concrete. Because of the lack of sufficient room at the site of the wall, the concrete mixing plant is located nearly one-half mile west, and the material is brought to the traveller in small cars, which are picked up by the derrick and dumped in the forms.

The wall forms are of steel, and are supported by a cantilever projection from the traveller. Their position relative to the traveller is regulated by turnbuckle adjustments in the vertical and horizontal supporting rods. When moving from one section of wall to the next the forms are lifted free of the completed work. The traveller moves on two rails, supported on timber blocking.

The wall is built in 50 ft. sections, and a section can be completed in two days. With the other necessary work it has been found that two sections can be completed per week, although the average to date, including all delays, has been one and one-half sections. At the joint between the first and second day's pouring a bond is secured to the adjacent rock face to which additional form supports can be fastened as required. After the wall is completed the new roadbed is back filled behind it. This traveller has proved very satisfactory for this work, and has enabled about 4,000 cu. yd. of concrete to be deposited monthly during the past spring without any interference with traffic, although the train movement is almost continuous.

THE PAW PAW WORK

A short distance west of this wall the new line leaves the old and passes through the southerly limits of the town of Paw Paw. Shortly after leaving the main line the new location passes through Carothers tunnel, 1,000 ft. long. The material encountered here and the methods of driving are similar to those described at the other tunnels.

One of the largest cuts on the line is at Paw Paw, where over 500,000 cu. yd. of material, largely earth, was removed. The maximum depth of the cut at this point was 96 ft. This material was hauled west to a point where the old line is to be thrown towards the river and raised 7 ft. to give room for a four-track line without disturbing the rock bluff and at the same time to raise the grade of the old line above high water.

A portion of this new fill extends into the river, and to protect it without at the same time encroaching on the stream, another retaining wall similar to that east of Paw Paw is being constructed for a distance of 3,300 ft. This wall has an average height of 24 ft. and is being built in the same general manner as the wall previously described, but here, as it was not necessary to span any tracks, a wooden traveller was provided to carry the forms only, and the concrete was deposited with a locomotive crane. Two sets of steel forms were provided for 30 ft. sections, and these are being used alternately. About 25,000 cu. yd. of concrete is required for this wall.

With the exception of the two crossings on the Potomac river, the only steel bridge on the line is an overhead highway structure crossing Paw Paw cut. There are also two 12 ft. and two 8 ft. concrete arches and several smaller openings. There are no grade crossings with highways.

One interesting feature of the work is the measures taken to prevent the workmen engaged in the construction of those portions of the line adjacent to the operated tracks, from be-

ing struck by trains. Because of the almost continuous movement of trains, and the necessity of men passing back and forth over the work, footpaths were constructed outside the tracks, either on the shoulder of the fill or where the bank was narrow, of trestle construction, and all employees are required to use these paths instead of walking on the track. Special instructions were printed by the road and given to the different contractors and company foremen for individual distribution among the men, who are required to read and sign them. The company has also stationed a number of private policemen along the line, whose duty it is to see that these instructions are obeyed.

This work was started in May, 1913, and it is expected that the new line will be placed in operation during the coming winter. The grading was 85 per cent. completed on July 1; the driving of all four tunnels has been completed; the lining of Randolph tunnel has been finished, and this work is actively under way on the other three tunnels. It is expected the track laying will be started before September 1. The substructures of both river bridges are completed and the erection of the steel work has begun. Automatic signals will be installed on this line, and interlocking plants will be built at each end.

This work is being handled under the direction of Francis Lee Stuart, chief engineer, and J. T. Wilson, district engineer, with E. M. Graham, T. C. Marshall and T. Ellett, Jr., resident engineers. Starting at the east end, the contractors on this work are: Section No. 1 and part of No. 3, Kefauver and McLaran, Baltimore, Md.; sections No. 2 and No. 4, and part of No. 3, H. S. Kerbaugh, Inc., New York; sections No. 5 and 7, Bennett and Talbott, Greensburg, Pa.; part of section No. 6, Sheesley & Janney, Johnstown, Pa.; part of sections No. 6 and No. 8, Smith-McCormick Co., Easton, Pa.; part of section No. 8, The James F. McCabe Co., Baltimore, Md. The American Bridge Company is fabricating and erecting the two bridges across the Potomac river.

ORGANIZATION OF THE MAINTENANCE OF WAY DEPARTMENT OF THE PENNSYLVANIA RAILROAD

At the present time there is a great deal of complaint about the inability of the roads to retain college-trained engineers in their employ, and also about the difficulty of securing a sufficient number of men capable of taking charge of maintenance of way work and of rising through this department into the operating department. On at least one road, however, these complaints are not found. This road is the Pennsylvania. Here, at the present time, a large majority of the operating officers, including division superintendents, rose from the maintenance of way department, from which it is evident that this road is retaining a large number of its technically-trained men who entered the service in that department. It is also evident that this must be the result of a definite system, and it is the purpose of this article to outline briefly the manner in which this system has been developed.

The Pennsylvania organization is strictly divisional, each division superintendent having on his staff a division engineer and reporting to a general superintendent, who, in turn, has an engineer on his staff with the title of principal assistant engineer. The general superintendents report to the general manager, who has on his staff an engineer maintenance of way. The engineer maintenance of way has three immediate assistants, the assistant engineer in charge of roadway and track, the assistant engineer in charge of structures, and the signal engineer.

Since the division is the unit in the operating organization, it is in the division engineers' offices that the maintenance corps of engineers is recruited. The different division engineers hire all men for the classified service, as this branch of special training is termed, as well as for the unclassified service, and applications received by the engineer maintenance of way and by the principal assistant engineers are referred to these officers. In this way there are always more applications for positions than there are vacancies.

Only graduates of engineering colleges of recognized standing are employed and they are started as classified rodmen on the division engineer's corps, either on field work or as draftsmen. Previous to employment they must pass the physical examination required of all employees of the road. They start at a definite fixed salary for the first year, and, if their services are satisfactory, they advance automatically at the end of the year to the second class at a higher salary, and, likewise, at the end of that year to the third class, and are known as third-year rodmen. The principal assistant engineers also maintain more or less of an engineering force in their respective offices, the men on which are drawn from the third-year rodmen in the division offices as vacancies occur. Some six or seven transit men are also attached to the office of the engineer maintenance of way and are drawn from the offices of the principal assistant engineers. Between 60 and 70 men are retained in the classified service in the division and district offices.

After spending from three to five years in the offices of the division and principal assistant engineers, the men in the classified service are brought into the office of the engineer maintenance of way at Philadelphia, where they are given a course in the elements of accounting, signals, maintenance of way records, bridge and building maintenance and valuation. From six to seven men take this course at a time, spending from one to two months in each department. From this office the men are sent out as assistant supervisors on branch line divisions.

An assistant supervisor in the district assigned him has the same authority and performs the same duties as the supervisor. In most cases he relieves the latter of the routine detail matter connected with the office work and the organization of the forces, so that the supervisor is enabled to spend most of his time out on the track. From branch line subdivisions the assistant supervisor is transferred to a main line sub-division, the main line being that portion of the road between Pittsburgh and New York and between Philadelphia and Washington. As vacancies occur the men are promoted from assistant supervisors on main line to supervisors on branch lines. The next move for the man is then to supervisor of main line sub-division. On the four-track main line a supervisor has charge of from 20 to 33 miles of road, while on branch lines of lighter traffic the sub-divisions are longer and may include as much as 150 miles of line. The supervisor reports to the division engineer. An average of from six to eight years is required from the time the man enters the service until he becomes a supervisor on branch lines.

The next promotion is to division engineer, first on branch lines and then on the main line. In this position he has charge of all maintenance work on the division, including the care of the track, bridges, buildings, water service and signals, and has reporting directly to him the supervisors of track, the master carpenter and the supervisor of signals, the master carpenter and the supervisor of signals having, in general, the same territory as the division engineer. From the time they enter the classified service and as they advance through the various grades, and are promoted to positions of greater responsibility, these men are under close personal observation of their superior officers as to their ability, capacity and application, all of which, as well as seniority, are taken into consideration in selecting men to fill vacancies as they occur. From division engineer the men may be promoted either directly to division superintendent or to principal assistant engineer and then to division superintendent.

Aside from the men in the classified service, the remainder

of the men required in the offices of the division engineers and the principal assistant engineers are in what is termed the "unclassified" service where the rate of pay of permanent force is slightly higher than in the classified service, but where there is no similar opportunity for promotion. While all of the men in the classified service are technical graduates, the same requirement is not exacted in the unclassified service and only a portion of the men here have a college education. Also in some few instances assistant supervisors are selected from promising young foremen, although the general practice is to secure men for these positions from the classified service. As indicated above, seniority alone is not considered in making appointments of supervisors, division engineers, division superintendents, etc., but the relative ability of the individual men is also considered. In this way some men rise to positions as supervisors or division engineers and are not promoted beyond this point.

By this system the Pennsylvania has in training at all times a sufficient number of men trained in its methods of operating and familiar with its standards to fill any vacancies which may reasonably be expected, and no men are appointed to positions of responsibility in the maintenance of way or operating departments from other roads. In this way the men also know that vacancies will be filled by promotion from the ranks.

MEANS OF INCREASING THE EFFICIENCY OF TRACK FOREMEN IN HANDLING LABOR

By W. E. Schott
Section Foreman, Southern Pacific, Gila Bend, Ariz.

With the increasing operating expenses of the last few years it has been necessary to reduce maintenance expenditures to the minimum, requiring roadmasters and section foremen to study means of securing the most labor from each man. To the greatest extent this task falls upon the section foremen, and since the material from which foremen are created is varied, more attention should be paid by railroad officers to their education and to instructing them either verbally or by monthly meetings regarding methods of working labor to the greatest advantage.

In most cases the roadmaster now judges his foremen by their ability to turn out the work, by the quality of the work and by their ability to secure, organize and retain laborers. If a foreman does not possess these qualities he is considered unfit and is replaced with a more capable man as soon as possible.

While this view is entirely correct under present conditions, and there is no remedy advocated or applied, it seems that by paying more attention to this subject this could be materially improved. The great disadvantage of present practice is the fact that a foreman discharged from one road will secure employment on another railroad, so that the procedure now consists mainly in exchanging inefficient foremen from one road for those of another road without really accomplishing anything.

There are innumerable suggestions which, if impressed upon the average foreman, will increase his value to his employers immensely. Large department stores endeavor to make their employees more valuable by giving them lessons in salesmanship. It is hard to understand why railroads have so far overlooked an item involving such great expenses as that connected with track labor. To gather such information and to convey it to the foremen in plain, easily understood language can and should be done by all railroads.

One of the foremost requirements which a foreman must possess to secure the best results from any gang is the good will of all his men. It is impossible for any foreman to work men to advantage if he is disliked by them. Brute force on the part of the foreman is a thing of the past and laborers will either quit or, as frequently happens, refuse to obey orders.

I would not suggest that laborers be allowed to take things easy or advocate a foreman becoming too familiar with his men in order to gain their favor. I think the latter attitude will tend more to undermine the respect for the foreman than anything else. He should be firm and should treat his laborers absolutely justly and without any partiality. By studying his men he will realize that in some cases a remark made in a joking manner will do more good than a severe reprimand, and vice versa. Many a good man has left the service because his foreman did not understand him.

Another important factor to be considered in handling labor is the locality. It stands to reason that a foreman employing a gang of Mexicans in Kansas, especially if there is a surplus of labor, can be more exacting and can work the men a little harder than a foreman employing Mexicans close to the border. In fact, the men work harder themselves if they are in a strange community where they cannot expect support from outside sources.

Another handicap of the average foreman is his lack of patience with the faults of his men. To be a good foreman he must realize the relatively small amount of intelligence possessed by the average foreign laborer. His patience will be taxed many times to the limit, but it is always better to tell a man repeatedly how to perform a task than to get mad and discharge him, for the chances are that the laborer whom the foreman will secure in his place will be even worse. By exercising patience many foremen will discover that cases of supposed stubbornness are not nearly as frequent as they had thought. Endeavor to keep the same gang if possible. It is no advantage to the employer or the employee to work continually with a gang of new men. An experienced man, even if of inferior intelligence, is always preferable to a green hand in track work, for, if for no other reason, it is safer to work with him. No foreman can make any progress without a well-trained gang any more than he can without good tools, and he should realize that it is to his own advantage to take good care of his men instead of abusing them and then ordering others from a labor agent.

All of these points can and should be impressed upon the section foremen at monthly meetings held at some convenient place and in charge of an officer who is able to make the meetings interesting and to secure the co-operation of the foremen. The section foreman out on his blind siding has to rely upon his own judgment more than any other railway employee and the roads would gain much if they would make efforts to improve this judgment. A good foreman is an asset for any railroad, while an inefficient one is a liability. To change many of these liabilities into assets should be as important to our railroad managements as any other movement for the betterment of the service; at least, it is worthy of a careful trial.

Up to the present time our track foremen have received their entire education during their apprenticeship under some experienced foreman and there is no doubt that many of these men have absorbed incorrect ideas with reference to handling labor. The average section foreman, like many other railway employees, has not received a high school education, and since a man equipped with a technical education is undoubtedly able to secure better results in these matters by applying up to date methods, the railroads should make it a practice to appoint such men to these positions for the purpose of having them transmit as much of their knowledge as possible to other employees who have so far been practical without any guidance in that line.

RAILWAY ELECTRIFICATION IN INDIA.—At the present time there are under consideration three important projects for electrification of railways in India as follows: the suburban railways of Bombay, the Ghats section of the Great Indian Peninsula and the suburban section of the Eastern Bengal State Railway at Calcutta.

Practical Considerations in Installing Turnouts*†

A Discussion of Important Elementary Principles of Assistance to the Foreman Putting in Switches

By W. F. Rench
Supervisor, Pennsylvania Railroad, Tacony, Pa.

The correct and expeditious placing of switch connections requires special qualifications both on the part of the foreman and his men and any important operation of that character should be placed in the hands of a gang expert in such work. Especially should the foreman be one whose ability and taste in the refinements of switch installation have been demonstrated beyond question, although it is almost equally important that his men be expert workmen, as generally what is to be done must be done quickly and completely.

Each supervisor's division should have several such gangs available and other gangs should be constantly in training so as to be able to take up such work when occasion requires. For this purpose the less important switch work, such as new sidings in private industry tracks, additional spurs in isolated locations, etc., should be delegated to the less experienced gangs and their efforts should receive greater assistance from the supervisor. Combining in the larger work a less experienced gang with an expert one is of excellent advantage to the former and no detriment to the general result.

The number of men required to constitute a first class gang for expeditious application of switch facilities in busy main line tracks over which passenger traffic is carried at speed and in considerable volume should be no less than 24, exclusive of the foreman and his assistant. Two of the laborers should be men qualified to act as flagmen; a third, whose dependability is unquestioned, should watch for the approach of trains and convey proper warning; a fourth is needed to carry water and look after the tools; ten should be capable spikers and all should be useful in general lines of work. Each individual of the gang should have a specific duty to perform when the rush is on after the use of the track has been given. The entire gang should fall into their allotted duties naturally and without the necessity of a preliminary line up.

The men who flag should be alert to display the warning signal the moment its necessity is communicated and should be educated to hold the banner against trains until unmistakably recalled. The display of the danger signal at the immediate location of the work should be the signal to proceed and should be the cue for the distant flagmen to act.

Only when the movements of all are automatic and instantaneous can the gang be regarded as well organized. Any members who are slow or awkward or inclined to run into the way of danger should be eliminated. The efficient foreman is able to indicate his instructions with a word, even a gesture, and should exact instant obedience. With the knowledge that his ideas have been trained by thorough familiarity with correct rules, he proceeds unerringly and his confidence inspires efficient co-operation in his men.

SPECIAL TOOL EQUIPMENT FOR THE SWITCH GANG

Besides the ordinary stock tools of any gang the switch gang should have a rail dolly to move rails quickly from place to place; a rail saw to cut the rails of proper length (a very frequent necessity in extensive interlocked switch work carrying specific locations of insulated joints); pneumatic rail drills for use whenever access to a compressed air line is possible; a hydraulic rail bender to break rails for temporary connections, to bend stock rails for accurate adjustment with the switch rail, and in certain cases to bend the rails to conform with the curve of the sharper turnouts, and, not least in importance, a tool which may be called the pick adze, because generally made in the blacksmith shop from an ordinary tamping pick, which is exceedingly useful in switch work for adzing beneath the rails, cutting off tie plugs used in respiking or cutting about spikes to facilitate their withdrawal.

The track gages employed should be only those whose accuracy has been tested and a steel tape divided into twelfths is practically a necessity for nice work. A metallic tape is good enough for measuring the lengths of the switch ties or to lay off their places in the connection, which should always be done by continuous measurements, particularly in slip switch work. A ball of twine for lining should never be lacking. As the switch gang is a floating one a substantial tool box is required and the design of one that has been found very acceptable is appended.

PRACTICE IN INSTALLATION

One of the essential details in switch work is a nice arrangement of the joints. Whether "housing" of the switch points is approved or not, the joints in advance of the point rails should follow a uniform standard. The joints in the two stock rails admit of little staggering, but this should be such that each joint has independent tie support. With the longer switch points no intermediate ties between the joints are possible unless long stock rails are used, the utility of which is doubtful.

Assuming 33 ft. stock rails and a 30 ft. point switch the joint on the main stock rail should be the one nearer the point of switch, because this will enhance the efficiency of the joint at the other end of this rail, which is a part of the main track structure. The distance in advance of the point of switch should be 4 ft. 7 in., which allows sufficient space ahead of the switch for the splice bar and spaces the joint at the reverse end of the rail one tie interval from the heel of the switch. The joint of the turnout stock rail should be 8 ft. 3 in. in advance of the point, which spaces the other end of this stock rail three tie intervals from the heel of the switch. The preservation of this uniform arrangement is desirable even though it may always require the cutting of shorter rails into the main track, and even though if space be limited it may necessitate a resort to the shortening of the lead somewhat, which may be done within the limits of 2 ft. for a No. 6 connection with an 18 ft. switch or of 8 ft. for a No. 20 connection with a 30 ft. switch and of lengths in due proportion for intermediate numbers. This uniformity is of course a necessity when stock rails "housed" at the mills are employed. As switches which occur together are usually part of a route across multiple track systems, the suggested arrangement would be duplicated for the adjoining switch with the result that the two switches would be separated 12 ft. 10 in., which, it will have to be granted, is a very favorable distance.

The elimination of joints from guard rails, desirable at all times, but essential with the employment of guard rail clamps and their fillers, is a well known requirement of nice work. The further arrangement of joints should be such as to use the shorter odd lengths of rail that are supplied with all rail orders to the usual amount of 10 per cent. and whose presence at other points is undesirable. For the best line no rail length less than 15 ft. should be employed. All rails should

*Copyrighted by W. F. Rench, July 17, 1914.

†An article on the important elements in the design of turnouts by Mr. Rench was published in the *Railway Age Gazette* of June 19, 1914, page 1542.

be drilled and the joints full bolted and tightened as much as possible before final line is established.

The point at which to introduce the angle in the turnout stock rail is one concerning which practice varies. A computation of the distance from the actual to the theoretical point of switch, assuming the former to be generally ⅛ in. thick, shows it to vary between 3 in. for a 10 ft. switch and 8 in. for a 30 ft. switch. But it is not possible to bend a rail to an exact angle at any point and the distance for each length of switch is soon found by practice for the bending apparatus available. The set should be made in the stock rail leading to the less important track, even though this would normally be the tangent from which the turnout seemingly springs. The important feature is to provide a smooth route for the faster or higher class traffic.

The spacing of the switch ties is a detail which should have careful attention. In main running tracks carrying fast passenger or heavy freight traffic with ties of about 9 in. face a spacing center to center of 22½ in. should be employed, which is equivalent to 18 ties to a 33 ft. rail and is equal in bearing area to 20 ties of a width averaging 8 in. This spacing is a convenient one because in the application of the rule for computing the bill of switch timber (described in the *Railway Age Gazette*, June 19, 1914) the increments become even fractions of an inch for the three most used of the higher numbers of frog, viz., ⅜ in., ¾ in. and 1⅛ in. for No. 20; ½ in., 1 in. and 1½ in. for No. 15, and ¾ in., 1½ in. and 2¼ in. for No. 10.

While this spacing would appear somewhat difficult of application by continuous measurement for the average foreman, facility may readily be acquired in adding 2 ft. and dropping back 1½ in. each tie space.

In private sidings and yards a spacing center to center of 27 in. is sufficient, which is equivalent to 15 ties to a 33 ft. rail or equal in bearing area to 17 ties of a width averaging 8 in. While this may seem excessive for such points from the standpoint of support for the rail, it is none too much to fully conserve the requirements of alinement. This spacing renders the increments in computing the bill 1⅛ in., 2¼ in. and 3⅜ in. for No. 8, and 1½ in., 3 in. and 4½ in. for No. 6. It is, of course, quite a simple procedure in laying out the spaces to go forward 2 ft. and 3 in. each time. The spacing in both cases would have to be modified in the event that hewn switch ties were employed.

It is desirable that non-interlocked switches in main running tracks should have the ground lever so placed that when set for the main track the rod connecting the switch with the switch stand is in tension. For switches that connect ordinary sidings whenever possible the switch stand should be on the right hand side of the switch as one faces the connection. Wherever a siding connects with a main track a derail should be installed in the siding at the clearance point to prevent cars being moved beyond that point by the wind, by error of train crews or by malicious persons, when no lamp or other indication would warn a train approaching on the main track of the danger. When no substantial bumper is provided the blind ends of sidings should be curved away from the main track. This should not be done in the case excepted, because if the momentum is great buckling toward the main track is certain, while if the siding continues parallel the chance of buckling away from the main track is an even one.

PRACTICE IN MAINTENANCE

Whether preliminary to the installation of a new connection or to the renewal of the timbers in the old it is of decided advantage to remove the ballast entirely to the bottom of the ties throughout the length of the connection. In no other way can economy of time be effected in the general respacing of ties that occurs both in their original application and renewal. An exception might be made when spotting of switch timbers only is being done, but this excellent and generally prescribed rule for renewal is seldom practicable, as the timbers are almost certain to be in a fairly uniform state of wear and decay. The entire removal of the old ballast assures a cleanly ballasted track, which is of great benefit both to the riding of the connection and to the life of the ties.

The tamping should receive especial attention, as the comfortable riding of switch connections is the exception rather than the rule. The practice of elevating the switch rail for safety introduces a very neat problem for the expert maintainer. A plotted profile of a succession of closely bunched switches in a main track is calculated to instill despair of fine results in riding, but it is well known that such results can be attained. In general, the joints at the heel of switches and block joints require the hardest tamping and the most frequent surfacing.

Proper line seldom obtains through main track switch connections because enough pains were not taken in the original installation to attain the maximum advantage in this respect. Correction can sometimes be made by separating the main track and the turnout between the switch and frog into independent units by unspiking the respective tracks upon alternate ties and throwing with the bars, completing the adjustment by careful spike lining. The latter should always be done by widening the gage rather than narrowing it. Care must be taken at the frog to preserve the correct guard rail gage at all times that service is permitted.

The cleaning and lubrication of the plates and other bearing surfaces of switches and of movable point and spring rail frogs is a very important item of maintenance. The prevention of sanding over switch connections relieves the maintainer of much useless labor and the road of much unnecessary expense for oil consumed. At the approach of freezing weather it is generally customary to remove the ballast from the tie spaces at frogs, switches and guard rails to facilitate the removal of snow and ice.

Frequent inspection of switches, both by the track foreman and signal maintainer, is necessary to guard against lack of adjustment, which may result in accident. These inspections should be made monthly for general condition, weekly for detail defects and daily whenever possible to detect small irregularities which might assume dangerous degrees in brief time. The limit of safe wear is a variable one, but as regards the frog it is about reached when the half inch point is worn one-half inch below the original top surface of the frog. As regards the switch, this can only be determined by the judgment of the inspector. Stock rails represent only nominal maintenance expense and should be kept in first class condition at all times.

Accurate line through the connection having been secured by careful attention to the rules given, the preservation of this can be assured only by a faithful use of tie plates and the rule should be made inviolable that every switch tie should be protected by these accessories. It is doubtful if treated switch ties, which are frequently of inferior soft woods are safe in connections of heavy service without the addition of tie plates. The use of white oak for all switch ties would be a desirable but probably unattainable ideal. The troublesome maintenance question caused by the running of switches can be largely met by a generous use of anti-creeping devices, both throughout the connections and for some distance along the main track in the opposite direction to that of the traffic.

PRACTICE IN OPERATION

In long ladders a great advantage in operation is secured by a plain designation of the switch leading to each individual track. Time is frequently lost in seeking the right switch and not infrequently greater time is wasted by correcting a false drill movement occurring through error in choosing the switch. This may be avoided by the addition of a target to the switch stand carrying the designating number or letter, so placed that the light from the switch lamp will fall upon

it and slightly inclined so the brakeman riding the car will receive information as to the track he is about to go upon. This banner should not be a fixed board that one might stumble over, but should be integral with the switch stand.

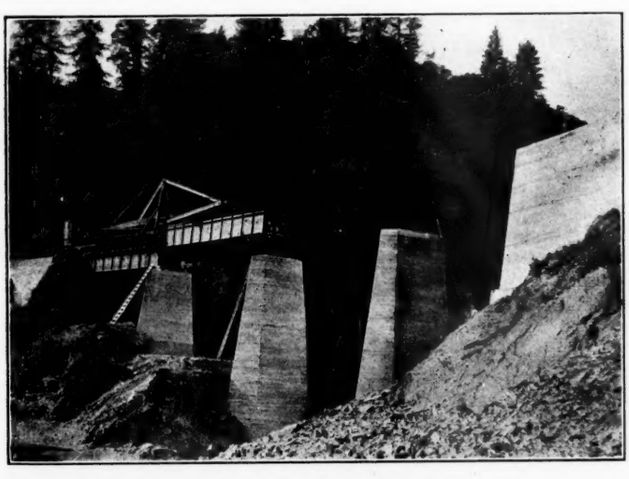
The important question from an operating point of view is what power should be allowed to work through certain numbers of switch connections and what speed limits such operation should carry. On account of the great variation in switch connections through local features of layout this question is better determined by the degree of curve that obtains for the particular turnout. When the use of no less radius than 175 ft. shall be general it may be considered that all classes of switch engines may safely use such a minimum curve.

It is a fair assumption that all ordinary types of road power may operate on a 23 deg. curve, or that of a No. 6 connection from tangent track. The speed should, however, not exceed 5 m. p. h. through No. 8 and No. 10 connections from tangent track, or from light curves at 15 m. p. h., and No. 15 and No. 20 connections similarly at 30 m. p. h. The degree that should be fixed as the limit for operation at 30 m. p. h. with no superelevation of track is 3 deg. 30 min., which represents an unbalanced elevation of 1½ in. for a speed 10 per cent. greater than that specified by the rule.

GIRDER ERECTION WITHOUT FALSE WORK

By William S. Wollner

An interesting example of the manner in which girder bridges may be erected without the use of false work is illustrated by the method used by one of the Pacific Coast railroads now constructing a line through the Coast Range mountains. The building of this road involves many stream crossings and the largest part of the cost of bridge erection is represented in the expense of hauling the material for false work to the bridge sites (when false work is used) and its erection for use. In some places it was found practically impossible to haul false work material to the bridge sites



Lowering a 60 ft. Span Into Place

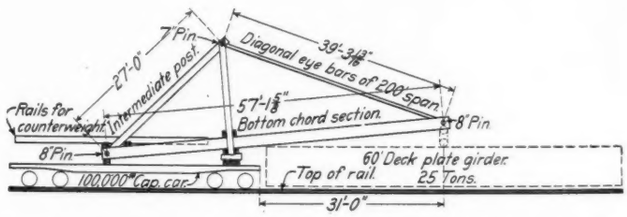
until track was laid to them and it was then necessary to stop laying track until the false work was erected and the bridges placed.

In order to reduce the cost of erecting bridges a method was sought which would obviate the use of false work and would at the same time create the minimum delay to the track laying. It should be remembered that this work was on a railroad under construction and that the methods used at times for placing girders on roads under operation could not be applied. The heaviest crane available for this work was of only 12 ton capacity and it was not considered advisable, in view of the small amount of work to be done, to endeavor to obtain a larger machine, which, if available, would have to be transported a long distance to the work. It was decided, therefore, to construct a derrick from parts of a 200 ft. deck truss span which was on hand awaiting erection when the track reached its location.

The equipment used for erecting these girders consisted of:

One 100,000 lb. capacity flat car,
Parts of a 200 ft. deck truss span,
Rails for counterweight,
12 ton capacity locomotive crane,
Blocks and tackle.

Two bridges were erected by this method; one consisting of three 60 ft. deck plate girder spans and the other of two



Derrick Car Made of Bridge Timbers and Used for Erecting Plate Girder Spans

60 ft. and two 50 ft. deck plate girder spans. The principal dimensions of these girders and the characteristics of the bridge sites were:

Bridge No. 1

Three 60 ft. deck plate girder spans, weighing 52,067 lb. each.
Center to center of girders, 7 ft.
Bottom to bottom of angles, 6 ft. 5¾ in.
Number of panels per girder, 10.
Height of South Abutment, 26 ft.
Height of Pier No. 1, 44 ft.
Height of Pier No. 2, 44 ft.
Height of North Abutment, 14 ft.
Alinement, 10 deg. curve.
Grade, —0.133 per cent.

Bridge No. 2

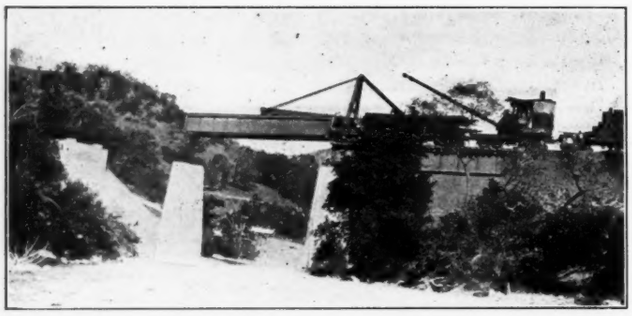
Two 60 ft. deck plate girder spans, as described above, and
Two 50 ft. deck plate girder spans, weighing 35,000 lb. each.
Center to center of girders, 7 ft.
Bottom to bottom of angles, 5 ft. 11¾ in.
Number of panels per girder, 8.
Height of South Abutment, 2 ft.
Height of Pier No. 1, 58 ft.
Height of Pier No. 2, 60 ft.
Height of Pier No. 3, 54 ft.
Height of North Abutment, 13 ft.
Alinement, 10 deg. curve.
Grade, —0.1053 per cent.

The accompanying sketch gives a general outline of the derrick. The boom consisted of a bottom chord section of the 200 ft. span made up as a latticed box girder 57 ft. 1⅝ in. long (between pin holes), 1 ft. 8½ in. bottom to bottom of angles, 2 ft. 9 in. deep. The back boom stay consisted of an intermediate post from the same structure, 27 ft. long (between pin holes), made up of channels, angles and plates and measuring in cross section 1 ft. 5⅛ in. square. The forward boom stay consisted of a diagonal eye bar from the 200 ft. span 39 ft. 3 13/16 in. between pin holes and 8 in. by 1¼ in. in cross section.

The girders were all riveted up in the general material yard and were hauled on flat cars to the site of the structure. As close to the nearest abutment as it was possible to place them they were unloaded onto rails placed upon the ground along the track and from these they were skidded on to the track. The derrick described above was mounted upon a 100,000 lb. capacity flat car with the pin hole 31 ft. ahead of the front of the car and this allowed the 60 ft. girder spans

to be handled with one foot clearance between them and the end of the car.

The derrick car was then propelled by the 12 ton locomotive crane to a position immediately behind the span, and tackle consisting of steel wire cable and bridge blocks was run from the center of the girders to the hoisting drum of the crane. The girders were then raised to clear the track and the whole outfit was then moved forward by the propelling mechanism of the crane until the span was immediately above its final position on the abutment and pier. It was then lowered into place and the tackle removed. The next span was then placed upon the track and the operation repeated, with the exception that this time the movement was made over the girders already placed to reach the piers upon which the suspended girders were to be placed.



Placing 60 ft. Girder Span With Derrick Working on Adjacent Span

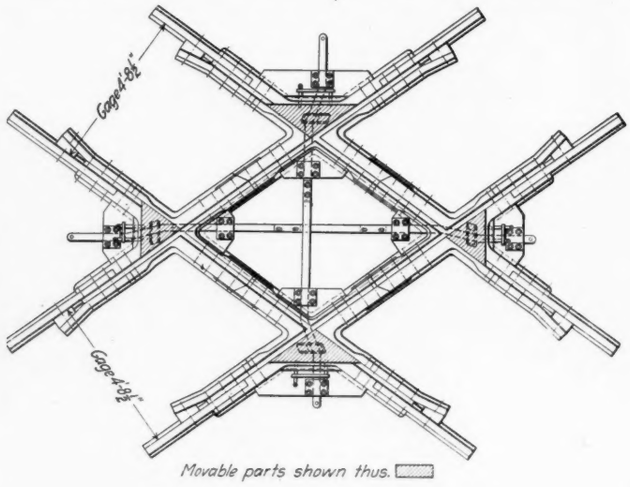
THE EYMON CONTINUOUS CROSSING

One of the principal disadvantages incident to steam road crossings is the break in the continuity of the running rails which is necessary with any rigid form of construction. These breaks not only transmit a jar to a train as the wheels pass over the interval, but the wheels themselves transmit severe blows to the projecting surfaces of the crossing, wearing these parts rapidly, and making it difficult to maintain any proper line and surface. For this reason there has existed a demand for a movable point crossing which will give a continuous running rail on either track as desired.

The Eymon Continuous Crossing

One of the simplest designs which have yet been brought out for this purpose is that of the Eymon Continuous Crossing Company, Marion, Ohio. This design consists essentially of four triangular movable frog points at the intersections of the gage lines whose movements are controlled by rods passing under the base, with horizontal offsets moving through lugs in the movable castings. These bars are directly connected with an interlocking tower, and move the points from one position to the other by the direct forward or backward movement of the bar without any intermediate points. To prevent the points from moving under a train, each corner is bolt-locked in its proper position by two bolt lugs, also operated from the tower independently of the movement controlling the point.

One of these crossings was installed in the main track intersection of the Pittsburgh-Toledo and the Columbus-Sandusky branches of the Pennsylvania lines at Carrothers, Ohio, on May 25, 1914, and have been in continuous service since that date.



Plan of Eymon Continuous Crossing

Both lines at this point are single track, and carry a relatively heavy traffic. Twelve passenger trains, and over 1,500 freight cars, many of which are heavily loaded with coal, pass over this crossing daily. While it is too early to secure any definite or conclusive data regarding the cost of maintenance, it is reported that no expense has been required to date.

The Eymon Continuous Crossing Installed at Carrothers, Ohio, Showing Interlocking Connections

This crossing is at an angle of about 70 deg., and is built of 85 lb. rail. It is of manganese construction, and weighs 6,900 lb. Before installation it was connected up at one side, and was then slid into place. A gang of 16 men removed the old crossing, placed the new one, and connected it to the interlocking plant, with the exception of the bolt locking, ready for a train to pass in 32 minutes.

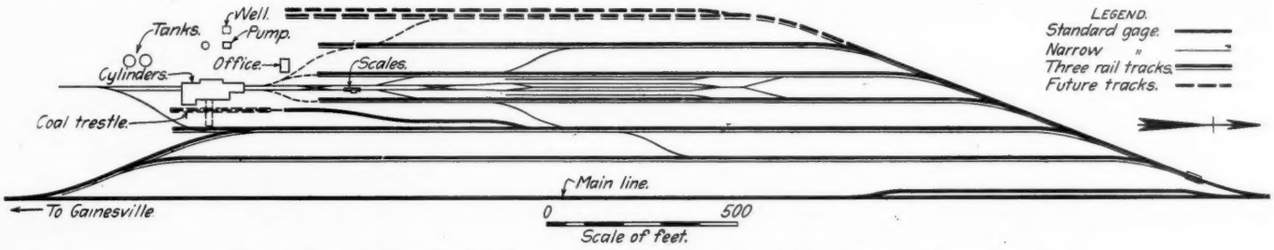
The Creosoting Plant of the Atlantic Coast Line

A Description of the Layout, Equipment and Method of Loading Ties at This Modern Southern Installation

The creosoting plant of the Atlantic Coast Line is located on a tract of level ground adjoining the main line tracks, just north of the city limits of Gainesville, Fla. The plant and storage yard cover about 30 acres, while there is sufficient additional space to provide for any probable expansion in the future.

As is common in Florida, the soil is light and sandy, and quickly absorbs the heavy rainfalls of the wet season. Permanent moisture lies at depths varying from 18 in. to 7 or 8 ft., and caused considerable difficulty in building the foundations for the main building and other structures. This was overcome by the use of Lackawanna steel sheet piling. The heavy loads are all supported on piling. The piling was driven and the concrete foundations were placed entirely by company forces.

The general arrangement is shown on the attached print.



Track Layout at the Timber Treating Plant of the Atlantic Coast Line, Gainesville, Fla.

Five main storage tracks diverge from a ladder track which connects with the main line at the north end of the yard, all of which are three-rail tracks. The plant building is located at the south end of the yard, and is connected with the main storage tracks and the loading platform by a system of 24 in. narrow gage tracks. A spur track connecting with track No. 2 reaches a proposed coal trestle on the east side of the main building, which is not yet built. The main building, machinery, power plant, storage tanks, water tower and water system, and tie trucks were furnished and erected by the Allis-Chalmers Manufacturing Company, of Milwaukee.

The main building is of steel frame construction covered with corrugated iron, and is provided with the usual steel shutter doors, wire glass windows and ventilating monitors.

A General View of the Treating Plant and Yard

Care was taken in the design to secure a well-lighted, cool and roomy building. It shelters the power plant, cylinders, overhead tanks and pumps and space for a small machine shop and repair part storeroom. The power plant consists of two 150 h. p. Scotch marine boilers, a Hoppe feed water heater, the necessary water feeding installation, and a 48 in. by 90 ft. self-supporting American ingot iron stack. It is separated from the cylinder room by a brick fire wall.

The main operating machinery consists of two cylinders, 6 ft. 2 in. in diameter and 138 ft. 7.5 in. long, of ¾ in. plate, provided with doors at both ends, and designed for 200 lb. working pressure; two 24,000 gal. working and measuring tanks 10 ft. 9 in. by 37 ft. 5.5 in., of ⅝ in. plate and built for 100 lb. working pressure; one 35,000 gal. underground tank, 10 ft. by 60 ft., of 5/16 in. plate; one 1,500 gal. drain tank; two sap drums; one air receiver; one 12 in. by 19 in. by 14 in. air compressor; one 10 in. by 16 in. by 10 in. vacuum pump; two 7.5 in. by 5 in. by 6 in. pot valve pressure pumps, and one 12 in. by 8.5 in. by 12 in. general oil service pump. The arrangement is such that the Rueping process can be used to the greatest advantage, but the Bethell process can also be employed. Prominent features are the large vertical overhead working tanks, and the mercury gages from which their contents is read.

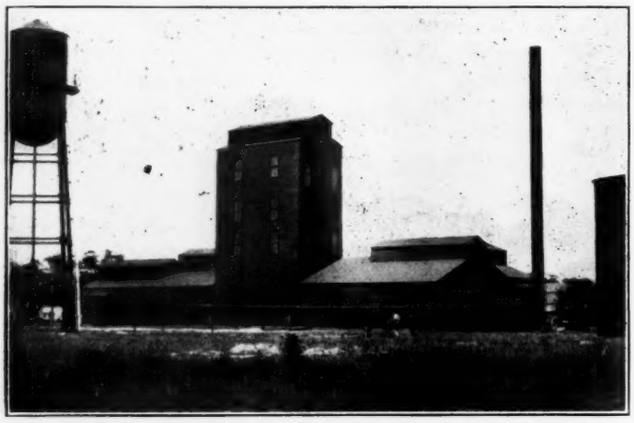
Light for the main building, the office, the pump house and the storehouses, as well as for the narrow gage yard and the loading platform, is supplied by a 30 k.w. generator with a direct connected engine, which is a possible source of power for such woodworking machines as may later be found necessary. A small complete experimental plant of standard design is included. The equipment of gages, both plain and recording, is complete.

Excellent boiler feed water is provided by an open surface well situated at the foot of the water tower and adjacent to the pump house. The latter contains one 10 in. by 6 in. by 12 in. water pump and one 14 in. by 7.5 in. by 12 in. standard underwriters' fire pump, both connected with the well and with the water tower. The tower is of standard steel construction and has a capacity of 45,000 gal. A 6 in. fire main with eight hydrants provides fire protection for the buildings and stock in storage. Other yard fixtures are two 150,000 gal. creosote storage tanks, 28 ft. 7 in. in diameter by 31 ft. high, and a 40 ft., 30-ton narrow gage track scale. The yard equipment consists of two 24 in. gage side tank switching locomotives, one 10-ton locomotive crane, 160 tie trucks and 24 piling trucks.

A storage capacity of 1,250,000 gallons of creosote is provided on deep water at Export Terminals, Jacksonville, Fla., by four tanks. The plant at this point is equipped with a boiler and pump for heating and transferring the oil in stor-

age. Six 10,000 gal. tank cars are employed in transferring creosote from Jacksonville to Gainesville.

On the Coast Line practically all crossties are bought delivered in stacks along the right-of-way. In order to load these economically for shipment to the plant, specially equipped flat cars have been assigned to this service, and a modified log-loader purchased to load them. The log-loader



View of the Main Building

places the ties on the flat cars in tiers parallel to the length of the car and the tiers are then securely strapped down to the car by chains fitted with log-binders. The outbound loading of treated ties at the plant is done either with the crane or by hand. Cars thus loaded may be handled to and from the plant either in regular freight service or in special trains. This method of loading and shipping ties in large

Looking Into the Retort Room

quantities was worked out on this railroad, and so far as is known, is new. It is proving satisfactory and economical.

Up to November, 1913, only longleaf heart pine ties bearing a small percentage of sap were treated by the Bethell process. Since then the Rueping process has been adopted for ties, and the specifications modified so as to include the coarser-grained, or "sap" ties. Pine piling and heavy timber and lumber are preserved by the Bethell process of treating.

The "eight-by-one" stacking method is followed, and the necessary seasoning period averages four months for crossties. Experience has shown the climate at Gainesville to be favorable for seasoning the classes of material handled.

The piece-work system of payment has been adopted throughout for handling crossties, except where mechanical handling is practiced. This works especially well with the negro labor with which the yard is manned, and results in making the negro a fairly satisfactory hand. Not enough material other than crossties has yet been treated to make possible the establishment of piece rates in such cases, but here "tasking" has been substituted for the piece rating wherever possible, and provides almost as great stimulation to the negro as the latter.

The plant is operated by Wm. A. Fisher, superintendent of timber preservation, under the direction of E. B. Pleasants, chief engineer.

PAINT PROTECTION FOR PORTLAND-CEMENT SURFACES*

By H. A. Gardner

In many instances it has been found desirable to decorate certain kinds of Portland-cement structures with moisture-proof coatings.† The appearance is thereby made more pleasing and the cement is protected from the destructive action of the elements. The author has occasionally come across statements which would tend to create an impression to the effect that Portland-cement surfaces are highly alkaline and cannot be satisfactorily decorated with oil paints. That such an impression is incorrect, seems to be the opinion of all investigators who have made painting tests of an extended nature. In fact, there is much evidence to show that Portland-cement surfaces are quite as well suited to receive paint coatings as iron, wood and other kinds of structural materials. Moreover, the results of well-conducted tests have shown that pure oil paints, such as are used upon wooden structures, may be used with equal satisfaction upon cement.

That the painting of cement is not a new art, is evident from the many references in the literature which describes methods of decorating and rendering damp-proof all classes of cement. Soon after Portland cement came into general use, it was customary to decorate certain kinds of constructions made from this material, the prevailing method being to apply varnishes containing copal, shellac, rosin or other resins, admixed with oil, turpentine and benzine. Subsequent to the application of such primers, a finishing coat of enamel made by grinding color pigments with the primer, was then applied. The principles underlying these old methods have since been followed with varying success, and up until a few years ago it was a common procedure for painters to apply a coat of varnish suction primer to cement and plaster walls, previous to painting them. Surfaces thus treated were filled, and made less absorptive, and from this standpoint they were in a somewhat better condition than bare walls to receive the final coat of paint or enamel.

The suction varnishes or fillers made for this purpose were of two classes. One widely used was made of rosin dissolved in benzine and admixed with linseed oil. The rosin was sometimes made more suitable by dissolving therein certain drying agents, such as red lead or lime. Lead or calcium resinate would thus be contained in these fillers. Varnishes made of the more expensive resins, such as Manila and copal, have also been used for the same purpose.

Whether these suction varnishes actually enter into chemical combination with the lime or other materials in cement or

* Abstract of a paper presented before the American Society for Testing Materials, in convention at Atlantic City, June 30 to July 3.

† This paper does not refer to treating cement masonry which is subjected to hydrostatic pressure and which may be in a very wet condition. Such masonry requires waterproofing rather than moisture-proofing treatment.

plaster, or whether they simply act as insulation coats, is a matter which has received considerable attention. If chemical reaction really occurs when a varnish coating is applied to cement, varnishes of the highest acidity, such as those made of colophony resin (common rosin), would be most efficient as lime neutralizers and better suited as primers, provided the durability of the coating is dependent upon the amount of calcium resinate which might be formed. Varnishes which have been prepared from the expensive resins generally show an acid number of from 5 to 10, while varnishes made from colophony resin (rosin) generally have an acidity of from 40 to 80. The author is inclined to doubt the possibility of lime neutralization by the use of suction varnishes. It is not a simple matter to produce calcium resinate under the most favorable conditions. Even molten rosin of 150 acidity requires prolonged heating at a high temperature, in order to take up as little as 2 to 3 per cent. of lime. When a varnish of low or high acid value is applied in the cold to a cement surface, drying occurs in an exceptionally short time, and there is no opportunity for the small proportion of resin present in such an extremely thin coating to effect a reaction which even under high temperatures takes place with the greatest difficulty. The effect which is really produced when a varnish is applied to a cement surface is not chemical, but of a physical nature, the varnish having a binding and filling effect upon the cement similar to the binding and filling effect which is produced by the application of certain types of oils to cement surfaces.

Probably too much importance has been attached to the alleged destructive action of lime upon cement surfaces. It is well known that setting Portland cement develops free lime, but the amount to be found upon a Portland-cement structure should be considered as negligible in most instances, as far as it might affect a well-designed paint. If indeed it is advisable to neutralize this small amount of lime, previous to painting the cement surface, such a result is not to be properly accomplished with an organic substance, but rather with an inorganic material which readily reacts therewith. A solution of zinc sulphate has proved most efficient for this purpose and has been used for many years with practical results, especially upon freshly laid cement. It might be well to point out at this place that the priming or ground-coating of cement is often improperly carried out when clear primers of any kind are used. If, for instance, a clear varnish is applied to a cement surface, the primed surface is difficult to differentiate from the untreated area. Consequently, the workmen using clear primers often leave untreated laps or "holidays," as they are technically known. For this reason, the use of color primers should be adopted wherever possible.

The dusting of cement floors, which is brought about by abrasion, may be effectively stopped through the use of oil-pigment paints. If the floor has been freshly laid and is damp, the possibility of lime reaction may be removed by treating the surface with a solution of tinted zinc sulphate. The oil paint may then be applied. Boiled linseed oil, sometimes mixed with Chinese wood oil, may be used as the liquid portion of the paint. These oils have a remarkable binding action when applied to a cement surface. When mixed with pigment, they form paints which are eminently suited as first coaters for cement floors. The first coat will dry rapidly and form a dense surface. Over this may be applied a second coat and, if a high gloss surface is desired, a portion of varnish may be added to this final coat. The various floors of the author's laboratory were treated in this fashion, with prepared floor paints made from such materials, one week after placing of the cement. The zinc-sulphate primer was used only upon the damp areas. The floors have since been subjected to much abrasion from constant walking and the moving of heavy apparatus. Oils and chemicals of various kinds have come in contact with the floors, and soap and water have been used upon them very often for cleaning purposes. After three years' continued service, the floors have not dusted and have never required repainting. The paint films are still in good condition. This service record would tend to show that placed Portland cement may be made dust- and wear-proof and highly desirable as a flooring material, through the application of oil paints.

In April, 1912, the writer instituted a series of tests to determine the durability of various types of paint upon Portland-cement surfaces exposed to the weather. The panels for the tests were prepared by constructing a long board wall to which was fastened expanded metal. A mixture of 1 part of Portland cement and 2 parts of clean Potomac River sand was made and applied to the expanded metal, forming a cement wall 3 in. in depth. The wall was divided into 35 sections or panels, each 30 in. wide and 40 in. high. Three coats of paint were applied to each panel by a practical journeyman painter. In order to make the test more severe, nearly all of the paints were applied in white. (Tinted paints are known to be much more durable than white paints.) A stripe of chrome green, 6 in. wide, was placed over the top of the third coat of paint, in order to determine whether the lime which might be present on the surface of the cement would have any effect upon the paint coating. Fading of the green to a yellow would indicate such action.

The general results of the tests at the end of a 2-year period, together with an outline of the composition of the paints tested, is given as follows:

Class No. 1.—Single-pigment paints made with white lead or zinc oxide ground in pure linseed oil. These paints are in very good condition throughout.

Class No. 2.—Combination-pigment paints made of mixtures of white lead, zinc oxide or similar pigments ground in pure linseed oil. These paints are in generally excellent condition.

Class No. 3.—Combination-pigment paints ground with mixtures of raw and heavy-bodied linseed oil or with treated Chinese wood oil. The viscosity of these oils requires the use of considerable turpentine or other thinner in the manufacture of such paints, in order to make them of the right viscosity for application. Semi-flat surfaces are therefore produced during the drying. Most of these paints are in excellent condition.

Class No. 4.—Single and combination pigments ground in oil varnishes containing acid resins. These paints are checking and scaling in many spots. Such varnish paints are apparently not suited to exterior exposure.

Class No. 5.—Paints containing resins dissolved in volatile spirits (spirit varnishes) with or without pigments. These paints are not giving very satisfactory service, the clear varnishes having entirely decayed in some cases. Those to which pigment has been added are in somewhat better condition.

Class No. 6.—Paints made with single and combination pigments ground in a water medium containing glue or casein as a binder. These paints are chalking rapidly and are not moisture-proofing the cement. The pigment binder has been destroyed by the weather.

Opaque white pigments, such as basic-sulphate white lead, basic-carbonate white lead, zinc oxide, and lithopone, were present in the paints which gave the best results. In some of these paints there was also present a percentage of inert pigments, such as barytes, asbestine, whiting, China clay, gypsum and silica.

The results of these tests are quite in line with the results obtained by Ware and Schott in a series of paint exposure tests made upon exterior concrete surfaces. They also agree with previous long-time exposure tests made by the author.

As a result, therefore, it can be stated that concrete surfaces may be decorated with excellent results through the use of high-grade oil paints. When the cement surface is freshly laid and damp, such paints may be safely applied after treating the cement with a zinc-sulphate primer.

THE BAGDAD RAILWAY OF ASIA MINOR.—The section of the Bagdad railway from Bagdad to Sumike, a distance of about 39 miles, was opened for traffic on June 3.

Discipline in the Maintenance of Way Department

Three Further Discussions of This Important Subject Which Is Now Receiving More Careful Attention

A discussion of methods of enforcing discipline in the maintenance of way department, by J. T. Bowser, was published in the *Railway Age Gazette* of June 19, page 1547. This subject has aroused considerable interest and we publish herewith three further discussions.

DISCIPLINE IN THE MAINTENANCE DEPARTMENT

By E. R. Lewis

Assistant to General Manager, Duluth, South Shore & Atlantic, Duluth, Minn.

Discipline in its broadest sense depends directly on the dispensation of exact justice. On the successful application of this principle depends the existence of all governmental bodies. The selection of officers in any organization, from the highest to the lowest, should be made with the administration of justice clearly in view.

To dispense justice, a man must necessarily have been well schooled in self government. Discipline, like charity, should begin, but not end at home. Unless he is able to govern himself, one cannot expect to successfully govern others. It is possible for a man of judicial temperment to learn the details of a business to be carried on under his direction after his appointment. It is hardly possible for a man who has not his own personality well in hand, to succeed as an employer or officer in charge over other men, be he ever so well versed in business details.

The ideal railway officer is one who is able and determined, by virtue of early training in self government, and by knowledge of the details of that which is to be done under his direction, to dispense exact justice in every case presented to him for decision, be it great or small. Such a man will select subordinates similarly equipped. His success will depend very largely on his ability to recognize and to keep men of this stamp. Much of discipline depends on the ability and persistence of officers to teach their subordinates these precepts, as well as their routine duties. Therefore, personality must ever be a prime factor of discipline.

Given an organization composed of officers and foremen so educated, the lines of authority must be most clearly defined and adhered to in order to obtain the best results. Confusion of authority is always to be deplored. Discipline is impossible under such circumstances. The wise officer will devote much thought to so arranging the spheres of action of his subordinates that there will be no possibility of overlapping authority. He will place as much responsibility on each man's shoulders as he shows himself capable of carrying. He will give to the business in hand the closest possible personal supervision, at the same time insisting on his subordinates doing likewise. The results, through the survival of the fittest, cannot but be of the best.

Justice, co-operation and close supervision are necessary to the success of large undertakings. There are many wrong ways and but one right way to maintain discipline. It applies to the maintenance department of a railway as well as to other departments or to other organizations. Discipline, in the sense of punishment, should be rarely necessary in a maintenance department which is well organized. That it is necessary at times, is universally recognized.

The provision of incentive to co-operation of all members of the department for the ultimate welfare of the company as a going concern is of the utmost importance. For with such co-operation, with each employee alive to the fact that his interests are identical with and bound up in those of the employing company, the necessity for punishment is reduced to a minimum.

The writer believes that the infliction of punishment by suspension and the presenting of cash prizes for excellence are alike opposed to the best interests of a railway company. The cash prize has a discouraging effect on the unsuccessful, while it tends to over confidence and carelessness in the successful. Many foremen are hired by the maintenance department to perform certain almost identical duties. They are all paid about the same wage. That wage is accepted as sufficient for the service rendered. There would seem to be no more reason for giving prizes for the best performance at the year end, than for offering bribes for services expected. Suspension is a direct loss to the department. From a feeling of disgrace on the first suspension, the victim passes to a resentful and irresponsible state of mind, making of his punishment an enforced holiday.

What, then, must be the incentive to co-operation? It must be something considered desirable by all concerned. Promotion and increase in wages are probably most appreciated. Choice of location and honorable mention are also desirable.

Where wages are fixed and promotions slow, as is the case in most maintenance departments, the merit system has been suggested and is undoubtedly of much value. Records of service should include in as much detail as possible, the personality and history of the subject. They should be checked with the periodical physical examinations; and they should be comparatively graded with a view to possible promotions. The value of merits, demerits and special honorable mention depends very largely on the publicity given them among members of the staff. Distribution of circulars to the staff announcing acts of special merit or demerit gives the necessary publicity so desirable in this connection. It is a small expense, its results are beneficial to the whole staff and the effects are far reaching. There should be a "best man" in every gang, capable of taking the foreman's place during leave or enforced absence from duty, during which periods the "best man" receives foreman's pay.

Most potent among the factors of excellence in the maintenance department is the permanent employment of the men. An efficient section-man or bridge carpenter, or pumper must have had experience. Steady employment and steady pay are the returns necessary to retention of desirable men, who are thus assured of that stability of income which will permit them to invest in homes in the vicinity of their headquarters. It is the inborn desire of every normal human being to possess a home.

The unfortunate, the abnormal, the mentally and morally deficient, the irresponsible rover and the untutored beginner only, are attracted by temporary employment. To such men discipline is synonymous with punishment only. The indifferent results obtained from the employment of such transient labor demonstrates the false economy bred of alternately sudden curtailment and augumenting of maintenance forces. The matter of discipline is as old as civilization and depends on the same broad, fundamental principles.

RECORDS VERSUS SUSPENSIONS AS DISCIPLINARY MEASURES

By Frank M. Patterson

District Engineer, Chicago, Burlington & Quincy, St. Louis, Mo.

Among the many suggestions offered for encouraging and retaining efficient help in the maintenance of way department the article of J. T. Bowser is worthy of serious consideration. It is trite to say that conditions in railway service are not what they used to be and it is the very truth of this oft repeated assertion that makes it trite. In a former period when our

railways were operated in smaller units it was no uncommon occurrence for a general manager to know personally the great majority of the section foremen on his system, and to have more than a superficial knowledge of their abilities. In the transition from what might be called a patriarchal administration to one more closely resembling an autocracy the section foreman complains, and in many cases with justification, that he has somehow lost some of his prestige and has become a mere cog in the machine instead of a member of the family; that if he fails in a single function he will be cast aside as ruthlessly as a damaged gear and replaced by another piece of machinery. The record proposed by Mr. Bowser will undoubtedly be an incentive to the foreman to strive to avoid reprimands and to endeavor to earn commendations if he feels that written entries are to be made of both.

There are, of course, certain flagrant offenses that justify, or, rather, demand instant discharge, but aside from these the record should be given due consideration and the foreman should be given the right of appeal to a higher officer if he feels that an injustice is being done. To inaugurate such a system would necessitate a large amount of work in collecting and tabulating the information of the men in service at the time, but once under way it would require little additional time or labor.

If it is to attain its greatest value, the record should be more than a mere chronological table of periods of service, reprimands and commendations and should furnish information as to the subject's qualifications in the various branches of his work, showing not only the things in which he excels, but also those in which he is deficient. It is true that a supervisor soon learns these things for himself, but with such a record before him a supervisor assuming charge of new territory would be enabled to keep his work better in hand and to know where to look for things needing attention than if he had to learn it entirely by observation.

Such a record would be of value also in making promotions, especially if the candidates are selected from different supervisors' districts. Seniority should, of course, be given weight, but not to the extent of overbalancing other qualifications. Aside from favoritism on account of relationship, politics or other extraneous reasons, there is nothing that will deaden ambition in any organization than making promotions solely by seniority. Fortunately the rule of seniority has obtained less in the maintenance of way department than in perhaps any other branch of railway service and it is to be hoped that this attitude will be preserved

In like manner a complete system of records would afford means of making shifts in the assignment of sections that would inure to the benefit of the service, for it is well known that a foreman may be almost a failure on one section and a success on another, be the cause temperamental, qualification for certain kinds of work, or what not. Conservation of resources is one of the most important subjects of the day, and a system that can transform two poor foremen into two good ones is more important from a railway viewpoint than one that will cause two blades of grass to grow where only one grew before.

The question of suspensions is a serious one and it is doubtful if suspension as a method of discipline is of any value whatever. Either an offense deserves dismissal, or it does not. If the latter, what good end is served if the employee must lose that which represents a part of his stock in trade, and the employer the services of a man whose services will be considered worth full value after the expiration of a certain period of idleness, with its attendant temptations? One of the most widely recognized principles of today in the relations between employer and employee is that fines shall not be used as a matter of discipline. Suspension is a fine reduced to its absurdest terms.

The system advocated by Mr. Bowser offers possibilities of great benefit, both to the railway and to the employer and it is to be hoped that it may be widely adopted. Certainly there can be no objections on either side to giving it a thorough trial.

SYSTEMATIC METHODS OF DISCIPLINE

By D. B. Johnston

Division Engineer, Pennsylvania Lines, Louisville, Ky.

Where the number of employees under one maintenance of way officer is so large that personal acquaintance with the individual man is not possible, some systematic method of applying discipline and maintaining records based thereon is necessary. However, as is found in other activities, the mere presence of a system and a series of records does not necessarily result in good discipline.

Mr. Bowser touched the keynote when he stated that it was certainly not advisable for roadmasters or division engineers to take from the road supervisors their disciplinary power. To this I would add that any discipline that is of sufficient importance to find a place in the record should be passed upon by the division engineer before being administered. This will tend to prevent hasty and ill-advised action and prevent the reversing of decisions.

While it is not necessary that the system of discipline adopted in the maintenance of way department correspond exactly with that applied to train men, the two should be so closely related that in the case of an accident involving employees in both departments the same methods of investigation and discipline may be applied.

I think the facts are that the amount of discipline necessary among maintenance of way employees is so small, as compared with that required with men in the train service, that at least, on the smaller roads, no elaborate and detailed system of administering discipline is necessary, and that so far all that is necessary has been accomplished by the exercise of good judgment on the part of supervising officers.

A DEEP WELL WATER SUPPLY INSTALLATION

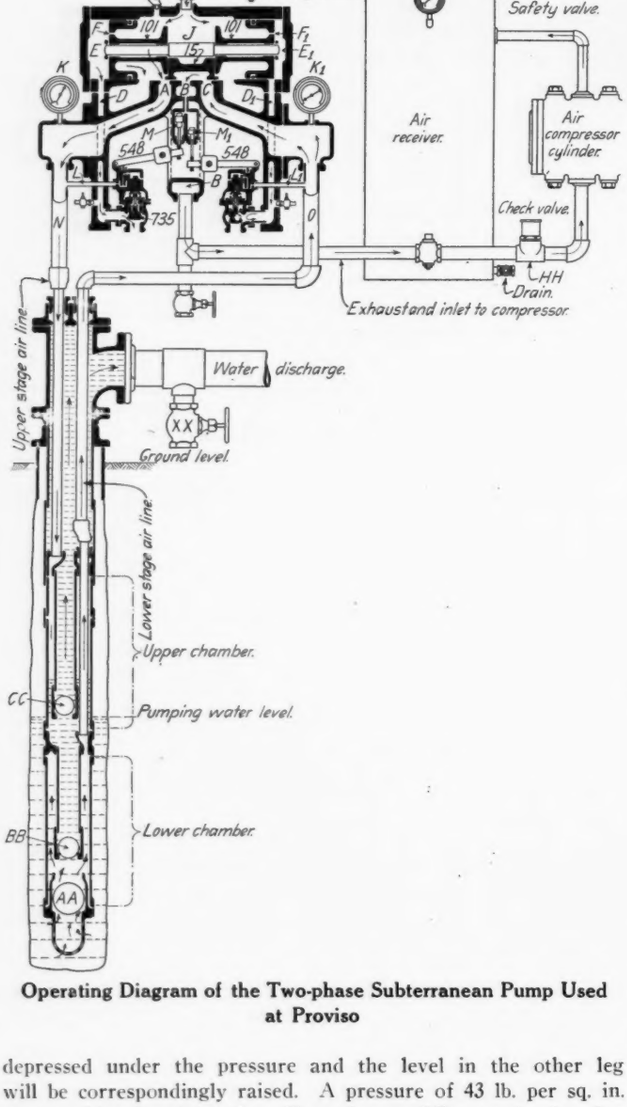
The Chicago & North Western secures the water supply for its engine terminal at Proviso, Ill., an important transfer and classification point about 12 miles west of Chicago, from eight wells, five of which range in depth from 1,825 ft. to 1,850 ft. and produce a very good grade of soft water for locomotive use. The other three wells are only about 1,200 ft. deep and produce hard water which is used for washing out engines and for other purposes where the quality of the water is not important. The wells are driven through sandstone, limestone and shale. Water is found in varying amounts in a number of the upper strata, but nowhere in this vicinity is a soft water supply obtainable above a depth of about 1,800 ft. The shallow wells are not cased except for a short distance near the surface to keep out the sub-soil and at occasional points where casing was necessary to keep out caving material. The deep wells are cased for their entire depth with the exception of the lower portion in the red Potts-dam sandstone from which the supply is obtained. The holes in the bottoms of the wells penetrate this sandstone for about 90 ft. The casing varies in diameter from 5 in. to 10 in., the sections decreasing in size towards the bottom. Each well is provided with a frame pump house, 16 ft. by 18 ft., lined with brick. The water is pumped into three 150,000-gallon steel tanks, the piping being so arranged that hard or soft water can be furnished to any of the tanks as desired. All pumps are electrically operated, the power being obtained from the power house at the roundhouse.

Each of the three shallow wells is equipped with a Downie double stroke deep well pump, fitted with a No. 34 pump-head and a 7¾ in. by 7 ft. working barrel placed about 160 ft. below the surface. These pumps are operated by direct connected 20-h. p., 440-volt, 60-cycle, three-phase electric motors, and each will furnish about 300 gal. of water per minute.

The soft water is delivered direct from the wells to the tanks

by five two-stage closed exhaust type subterranean pumps provided by the Weber Subterranean Pump Company, New York. These pumps belong to the class in which the air comes in direct contact with the water as distinguished from those in which the air and water are contained in separate cylinders. Their operation is based on the displacement of the water by the application of compressed air to the upper surface of the water column, in contrast to the air lift type in which the air is introduced under the column of water, lifting it partially by its buoyancy.

The operation of a displacement pump is most readily understood by considering its simplest form, a U tube. When submerged in water, the U tube will fill to the same level in both legs if provided with an inlet valve. If compressed air is applied to the upper surface of the water in one leg, that level will be

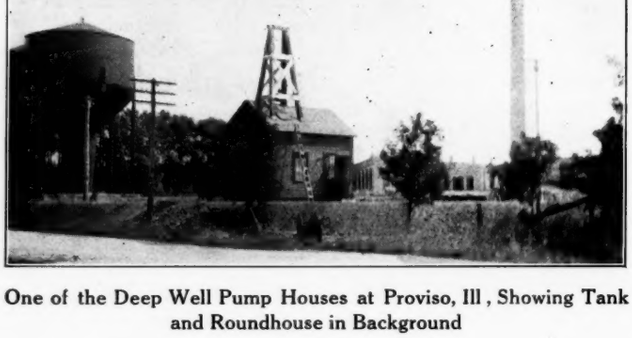


Operating Diagram of the Two-phase Subterranean Pump Used at Proviso

depressed under the pressure and the level in the other leg will be correspondingly raised. A pressure of 43 lb. per sq. in. on one side of such a tube will produce a difference in elevation of 100 ft. between the water surfaces of the two legs.

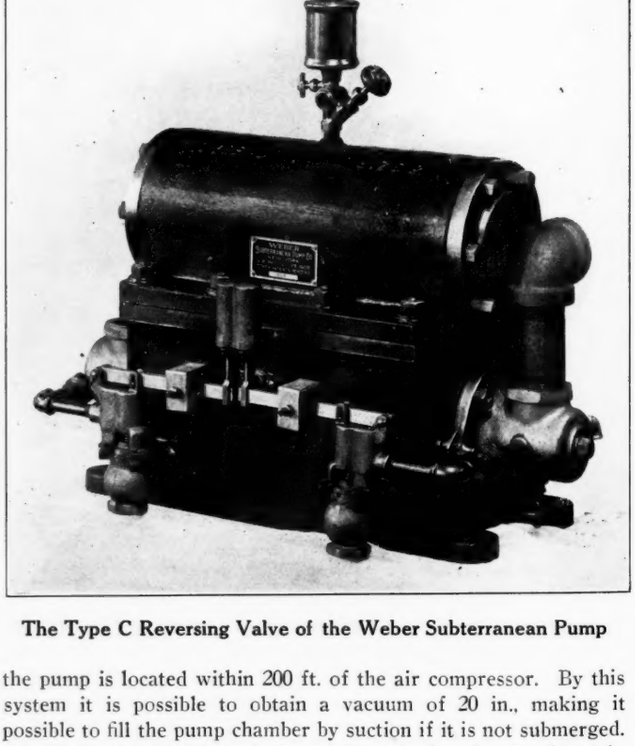
In the Weber subterranean pump the same result is secured by using concentric pipes, the outer being the intake chamber and the inner the discharge pipe. The water enters the intake chamber through the lower end of the pipe and its entrance to the discharge pipe is controlled by a hollow ball valve at the lower end of that pipe. When there is no air pressure in the pump chamber, the water rises to the level of submergence and when the pressure is applied from above the intake valve is closed and the discharge valve is opened, forcing the water up through the discharge pipe. To fill the intake chamber with water again the air must be exhausted, this being accomplished by a reversing valve in the air line between the air receiver and the pump.

As the water level in the deep wells at Proviso is from 230 to 250 ft. below the surface when the pumps are running, it was necessary to install two stage pumps in order to use a normal air pressure. These pumps require duplex or double acting reversing valves. The lower stage discharge pipe fills the upper



One of the Deep Well Pump Houses at Proviso, Ill, Showing Tank and Roundhouse in Background

stage intake chamber from which the water is forced in turn through the upper discharge pipe to the tank. By increasing the number of stages, it is possible to pump from depths of 1,000 ft. or more with ordinary air pressure at fair economy. An important saving in power is effected in the Proviso installation by returning the exhaust air from the pump to the compressor inlet. It is estimated that a saving of 35 per cent. in the total power necessary to operate the compressor is effected by this means. This expedient is possible in any installation of this kind when



The Type C Reversing Valve of the Weber Subterranean Pump

the pump is located within 200 ft. of the air compressor. By this system it is possible to obtain a vacuum of 20 in., making it possible to fill the pump chamber by suction if it is not submerged. An automatic unloading device with a check valve is placed in the intake air line to the compressor, in order to restore to the line any loss of air due to leakage or absorption.

The Class C reversing valve which is used in the Proviso in-

stallation is illustrated in the accompanying photograph and drawing. The operation of this double reversing valve is so timed that the air pressure in one well chamber is at a maximum at the moment when the pressure in the other chamber is at a minimum. These pressures are predetermined and are adjusted by the weights on the valves. The compressed air is brought into the top of the reversing valve shown as *J* in the drawing. From this chamber it is directed by means of the slide valve to one of the air lines *N* or *O*, leading to the upper and lower stages of the pump respectively. The main valve is of the three-ported slide valve type, similar to those used in steam engines and direct acting steam pumps. The slide (15) is moved automatically by the spool shaped plunger (101) to open and close the ports *A* and *C* alternately to admit and exhaust the air to and from the pump chambers.

In the accompanying illustration the slide valve is about to move to the left to shift the pressure from the upper to the lower stage. As shown by the gages *K* and *K1*, the pressure in the upper pump chamber has reached the maximum, forcing the water up through the discharge pipe and the pressure in the lower chamber is at the minimum, practically all of the air having been forced up the pipe and out through the exhaust inlet to the compressor by the incoming water. The movement of the slide valve to the left which is about to occur is effected by transmitting the working pressure through the port *L* to a piston acting upward against the weighted lever (548). When the pressure in the air line *N* reaches the maximum, it is just sufficient to force up this weighted lever which has just occurred in the position shown in the sketch. The raising of this lever opens the release plunger (735), permitting the escape of air from the auxiliary ports *D E* which are connected to the chamber *J* through the small port *F*. The release of the pressure in *E* unbalances the main plunger (101) since momentarily the pressure is greater in the port *E1* at the right hand end. In the drawing this unbalanced pressure is about to cause the movement of the slide valve to the left. This movement will deflect the compressed air through the pipe line *O* to the lower stage of the pump closing the valve *A A* and opening the valve *B B* to refill the intake chamber of the upper stage. At the same time the upper stage air line will be connected to the exhaust inlet through the port *B*, allowing the air to escape from the upper chamber as the water enters.

As mentioned above, this exhaust air enters the compressor cylinder and is used over and over. The air supply valve for making up losses due to absorption or leakage is shown at *H H*. Two retarding or buffer valves *M* and *M1* are provided, connecting with the exhaust *B* to prevent premature and irregular reversals of the valve. As the upper surface of these pistons is subject to the pressure in the exhausting pipe, these valves serve to keep the weighted lever in place until the air is fully exhausted from one chamber and has reached the full working pressure in the other chamber. These pistons can also be adjusted for vacuum control when desired.

The top of the lower chamber is placed about 10 ft. below the pumping water level to insure a sufficient head to completely fill the intake chamber of the lower stage by gravity. The valve *X X* in the water discharge pipe is provided for flowing wells, so that when the pump is not running the water can be kept out of the reversing valve. The discharge pipes are usually designed to retain a water seal over the discharge opening. To do this, the maximum working pressure should always be less than the pressure required to force all of the water out of the intake chamber down to the level of the discharge pipe valve. This difference in pressure is usually fixed at 2 or 3 lb. The reversing valve is adjusted to allow the water chamber to fill completely with water. The number of reversals depends upon pumping conditions. In general two reversals per minute are to be preferred to four. The discharge from a two-stage pump is intermittent, but the load on the compressor varies uniformly and the receiver pressure is nearly constant.

Each of the pumps at Proviso is operated by a 10 in. by 10 in. air compressor driven by a 35 h. p., 440 volt, three-phase, 60 cycle, 1,200 r. p. m. motor, the air being stored in a 36 in. by 80 in. air receiver. The power exerted by the motor during each cycle varies between that required to overcome friction of the parts and about 33 h. p., making the average about 20 h. p. Although the maximum load is only instantaneous during each cycle, the motor is designed for this load to prevent heating. The compressors, air receivers and motors are located at the well in order to get the greatest efficiency out of the return air arrangement as explained above. The pumps at wells 1, 3, 5 and 9 were tested soon after the installation was made with the following results for 1, 5 and 9. The test on well 3 was not satisfactory owing to the fact that the area between the pump chamber and the well casing was too small to permit a sufficient velocity of inflow. The small casing has since been replaced by a larger one and larger well fittings have also been substituted, bringing the performance of this pump up to that of the others.

Well No.	1	5	9
Pump run (gal. per minute)	95	105	128.81
Current used, k.w. per hour	18.87	...	21.2
Current used, k.w. per thousand gallons	3.3	3.43	2.74
Current cost at 2c. per k.w.	6.6	6.86	5.48

The receiver pressure during these tests was about 100 lb. and the pressure in the pump chambers about 98 lb. per sq. in. These tests showed a pump run varying from 95 to 128.81 gal. per minute. These pumps are designed for a capacity of 150 gal. per minute, pumping from an elevation 250 ft. below the surface to 60 ft. above ground, but this capacity could not be obtained in these wells because all the water that the wells yielded is represented by the figures shown in the test. This fact was proven by a very elaborate experiment undertaken with one of the Weber company's internal exhaust type of air pumps. This pump was placed about 400 ft. below the ground surface and was supplied with air through a 4 in. main from a large 1,600 cu. ft. compressor. No attempt was made to meter the air, as the desire was simply to determine the maximum yield of the well to a given pumping water level. After a series of tests of this kind the yield was practically the same as that shown by the two-stage displacement pump.

In reference to the cost of pumping shown above the manufacturer regularly guarantees for these pumps in this service a cost of one cent per 1,000 gal. for every 100 ft. of lift, this price assuming the use of a steam-driven compressor with coal costing $3 per ton. For the Proviso installation, requiring a lift of 300 ft. this would mean a cost of about three cents per 1,000 gal. This checks quite closely with the cost determined by the tests since the cost of electric current is approximately twice that of a steam-driven compressor on account of the double conversion of power. The cost of six cents per 1,000 gal. under these severe pumping conditions is considered very favorable. The advantage of reliability was even more important in the selection of these pumps than that of efficiency and low cost. It is stated that up to date the repair account on these pumps has been negligible, although they have been in continuous operation more than a year working 24 hours a day most of the time. The maintenance cost for these pumps is kept low by the slight valve wear characteristic of the ball valve. Except when seated, this valve is balanced by the water pressure on all sides and it is free to seat in a new place each time. A 4½ in. ball which has been in service three years is said to be only 0.006 in. out of true.

ARGENTINE RAILWAY EXTENSION.—A government decree has recently approved the plan presented by the Central Argentine Railway for the construction of a branch between Las Rosas and Villa del Rosario. The government has also ordered that the following sums be paid to the administration of the state railways: For completing the line from Dean Funes to Laguna Paiva, $212,300; for equipment on the state railways and maintenance of way, $2,654,000; for the construction of a railway from Nare to San Javier, $255,000, and $212,300 for the construction of the railway line from Talapampa to Rodeo de las Latas.

The Extra Gang Versus the Regular Section Gang

A Discussion of the Relative Merits of These Two Forces in Handling the Routine Maintenance Work

By W. J. Potter

The present demands of railroad maintenance call for extensive renewals of track and roadbed and give rise to a condition which requires the organization of an extra and efficient labor force, or a decided increase in the present established gangs. There are roads whose traffic conditions and engineering features are such as to cause more rapid depreciation of roadbed in some places than in others. Upon these roads the extra gang is at once a problem and the solution of a problem. The extra gang is an efficient institution only so long as it appears to aid in the proper and economic maintenance of track. It is the result of the operation of conditions which tend to prevent the proper type of labor from remaining on the track. The meagre pay, the onerous work and the lack of consideration shown the track laborer have all combined to drive the best types of labor from the field.

EXTRA GANG A NECESSITY

To make extraordinary replacements and extensive renewals, while at the same time maintaining the track up to standard, requires an increase in the regular forces. This seasonal increase is a recognized maintenance cost. It is in the distribution and administration of this labor that the most trouble arises. The extra track gang must perform any task in connection with the track or roadbed. The neglect of trackmen which all railroads have been guilty of has so reduced the efficiency of the supervisory force that four foremen in every five are unable to install a slip-switch or derail. The extra gang must install turnouts and crossovers, as well as renew rail and ballast when any considerable stretch is to be replaced. It must assist in routine work when the regular gang falls behind. In short, any and all work over and above the ability of the regular forces falls to the extra gang for completion.

The field of the extra gang and the reason which should justify its existence is the most neglected. I speak of the extra gang as a training school for prospective section foremen. The adoption of this idea would eliminate haphazard selection of supervisory material, would enable the prospective foreman to learn every type of maintenance, and give him a thorough understanding of the higher ideals of track work—the maximum results at the minimum outlay. By coordinating theory and practice these student foremen would become proficient in a year's time. They should be paid $1.75 per day and be given sections as soon as vacant. They should be recruited from the road sections in the first place and appointment to the extra gang should be considered as a promotion.

DOES THE EXTRA GANG PAY?

The work of the extra gang is not as a rule entirely satisfactory. The nature of track work requires that maximum results be achieved during the eight mild months of the year. Regardless of cost the work must be done, but one cannot increase by any considerable margin the maintenance cost of this predecessor, or his fellows on other divisions. The extra gang performs the overflow work. Upon the formation and direction of this gang depends whether or not it becomes an excessive maintenance cost. The extra foreman, overseeing a force too large for proper supervision, and charged with the rapid completion of the work and also knowing that there is little or no possibility of small discrepancies in the work being laid at his door, rushes the job, often at the cost of permanence and strength. The old dilemma of quality versus quantity is here exemplified. Like a profit and loss statement the gross returns show large, but it is the net returns that should determine a man's standing. So with the work of the extra gang—the report of work done shows large, but the discounting of mistakes and duplications, and the necessity of work done being ripped out and done over considerably reduces the ultimate gain.

The men in the extra gang pattern themselves after their foreman in subserving permanence to outward show. I have seen track which had been raised by an extra gang where the tamping was so poorly done that there was very little ballast under the ties. In rapidly inspecting work the average foreman will not take a pick and test for firmness if he sees the rock well scratched. It takes a blow of at least 30 lb. to properly test a tamped joint. The average foreman is not going to put in a couple of hours each day doing this, and at the same time attempt to properly supervise a gang.

LOSSES IN THE EXTRA GANG

While visiting an extra gang this summer my attention was attracted to three men who were a little apart from the rest of the gang, yet within easy reach of the foreman's voice. I took a record of the actions of these men for an hour and at the end of this time I found that, deducting the time these men wasted, the time actually worked averaged 40 minutes to the hour. One Italian visited the water pail four times during the hour and the other two each twice. Each rinsed the dipper thoroughly, drank deeply and when satisfied threw away at least half a dipper full each time. The time consumed at the water pail by the men was eight, four, and three minutes, respectively, or an average of five minutes each for water alone. Of course this would have been noticed in the gang proper, if every man did likewise, but a record of the average time lost per man in the gang proper was ten minutes per hour. The men had no rest periods, so whenever a man felt tired he straightened up for a minute. The gang was working in cinders and it was a revelation to see how the laborers fooled the foreman. When he would get a little distance away one would stop working and stand with knees bent inward over his shovel and back bent. When several men were directly in line, as they were in tamping, the foreman could not tell if one man was "soldiering" or not.

In this gang of 30 men 300 minutes mere lost every hour, equivalent to $0.80 lost every hour, or $8 every day. Figuring that one-half of the time lost was really necessary for recuperation this still amounted in the season of 200 days to $832. Some will say the foreman has enough to do without bothering with such trifles, and so he has, but an assistant foreman at $2 a day could pay for himself and at the same time save the company money by watching such trifles. In this gang when every man went to the water pail when he felt thirsty it took two men to furnish sufficient water. Upon drawing the attention of the foreman to the waste, a new system was inauguraed whereby twice an hour the water pail went down the line and every man drank as much as he wished. The water boy was instructed to see that the men drank all they took, and that they did not take any more than they could use. The result was that one man was taken off the water bucket and put on the regular work. This was direct gain of the man's wages, representing $1.60 per day, or $332.80 in the season.

The extra gang performs the overflow work, yet the manner of so doing results directly in two sources of loss to

the railroad. First, the morale of the department suffers. Where prizes are offered for the best conducted sections, the mere presence of the extra gang on a foreman's section detracts from his percentage. Knowing this and also the fact that all mistakes will be chargeable to him, and that he will be still further hampered by going over the same work for a couple of days after the extra gang has departed, makes the foreman apathetic and less scrupulous.

After the extra gang has departed the results of the work begin to show. A rail kinked in unloading and spiked in begins to buckle. Poor tamping causes the rail to sag and the ties to churn under traffic. Rails spiked off gage must be gaged and respiked.. Then the treated tie has a hole that should be plugged, and even when plugged the tie has received a wound that results in its destruction before the normal time. When stone is being placed the grade is often neglected, and as a result the regular gang puts in a couple more days rectifying this. All this duplication is a direct loss and works additional hardship on the regular foreman, as his own work is being neglected while correcting errors that a little more care would have prevented in the first place. The following typical time sheets illustrate the extent of this duplication:

EXTRA GANG LABOR SHEET

Date	Foreman	Assistant foreman	Men	Time starting	Time completing	Hours worked	Job
May 31, 1912	1	1	30	7:30 a.m.	5:30 p.m.	9	Relaying rail.
June 1, 1912	1	1	29	7:30 a.m.	5:30 p.m.	9	Relaying rail.
June 2, 1912	1	1	29	7:30 a.m.	5:30 p.m.	9	Installing derail.
June 3, 1912	1	1	29	7:30 a.m.	5:30 p.m.	9	Installing Xover.
June 4, 1912	1	1	30	7:30 a.m.	5:30 p.m.	9	Installing Xover.
June 5, 1912	1	1	32	7:30 a.m.	5:30 p.m.	9	Installing Xover.
June 6, 1912	1	1	24	7:30 a.m.	5:30 p.m.	9	Relaying rail.
June 7, 1912	1	1	29	7:30 a.m.	5:30 p.m.	9	Relaying rail.
June 8, 1912	1	1	30	7:30 a.m.	5:30 p.m.	9	Ballasting and scrap collection.
June 9, 1912	1	1	30	7:30 a.m.	5:30 p.m.	9	Ballasting and scrap collection.

SECTION NO. 40—TIME SHEET

Date	Foreman	Men	Time starting	Time completing	Hours worked	Job
June 10, 1912	1	10	7 a.m.	6 p.m.	10	Grading, lining, removing kinks.
June 11, 1912	1	11	7 a.m.	6 p.m.	10	Grading, lining, removing kinks and surfacing.
June 25, 1913	1	14	7 a.m.	6 p.m.	10	Leveling anchor beams at derail.

The above record shows a complete loss of 350 hours' time at $0.16 per hour, or $56 in addition to the depreciation of the anchor beams, plus the added transportation of extra material, and the loss occasioned by the absence of the regular gang from its own work.

THE PROPER ORGANIZATION OF THE EXTRA GANG

In assembling an extra gang many little but nevertheless important details are passed over as too trivial for consideration. I find that in track work it is the small things that reduce or increase expenses, for the reason that they are not as carefully watched as the larger counts. The first consideration to be decided on is whether the gang shall work from a fixed base or be moved from siding to siding as needed. On the Scranton division of the Lackawanna extending from Washington, N. J., to Scranton, Pa., two extra gangs are located at Stroudsburg, and at Tobyhanna, each with a working radius of about 40 miles, the maximum efficient working radius. I think the fixed base is the best and the cheapest.

The next consideration is whether one gang shall handle only one type of work or shall be called upon for every class of work in track maintenance. Except on track requiring highly specialized work, such as installing interlocking systems, I think the gangs should perform all types of work.

The question of nationality in the making up of gangs is an important one. The Hun is a steady worker, but he is ignorant and hard to teach; the Italian learns quicker, but he is temperamentally lazy. Bickering among men of different nations is continuous, so, to prevent dissension, it is well to man a gang entirely from one group or divide the men into groups of like nations. I have heard the plan advocated of collecting men of different nationalities into one gang, but this creates bad blood in the gang and disrupts it.

The extra gang must be of a size easily handled. No man can properly supervise more than 25 men. I suggest the following organization for a ballast gang:

Foreman

Assistant foreman	Assistant foreman
2 jackmen	2 jackmen
1 jack tamper	1 jack tamper
1 sledgeman	1 sledgeman
2 men filling in	2 men filling in
15 tampers	15 tampers
1 flagman	1 flagman
1 water boy	1 water boy

This gang ought to reballast and surface three miles of track after an 18 in. raise in a month at a cost of $220 per 1,000 ft. of track.

The following is the most efficient sized gang for laying steel:

1 foreman	10 tongmen
2 assistant foremen	8 spike pullers
1 flagman	8 spikers
1 water boy	10 miscellaneous
8 adzemen	

This gang will lay track, taking out the old steel and replacing with new, at the rate of about 6,000 ft. per day. In doing this with 101 lb. new rail they will place 42.86 tons of rails, 134 pairs of splice bars, 804 track bolts, 804 nut locks, 5,700 screw spikes, 2,400 tie plates and 1,000 yd. rock ballast, at a cost, counting material and labor, of $2,580.94.

HANDLING WORK WITH A REGULAR SECTION GANG

While it would be profitable from an economic standpoint to maintain section gangs of a size sufficient to handle all renewals, it would materially increase the maintenance cost of track. For a three-mile section of heavy traffic under a capable foreman all renewals and replacements can be handled by a force of twelve men in summer and eight men in winter. This would necessitate paying a higher salary to the foremen. The present cost of maintaining a section with eight men in summer and four in winter is:

Foreman, 12 months at $70	$840.00
8 men, 208 days at $1.60	2,662.40
4 men, 104 days at $1.60	665.60
Annual expense per section	$4,168.00

With the plan of permanent section gangs the cost would be:

Foreman, 12 months at $80	$960.00
12 men, 208 days at $1.60	3,785.60
8 men, 104 days at $1.60	1,331.20
	$6,076.80

Comparing a 35 section division:

Total cost of sections ($4,168 × 35)	$145,880.00
Cost of two extra gangs	17,500.00
Total labor cost of one division	$163,380.00

On a 35 section division without the extra gangs and with the large permanent gangs the cost would be ($6,076.80 x 35) $212,688.

These figures are based on every man working every day. The $49,308 difference between the two methods could be cut down at least 50 per cent, leaving the margin as the price of safety.

The expense of the extra gang is alone 10 per cent of the total labor maintenance cost. The annual expenditure for labor at present is $163,380, of which the cost of the extra gangs is $17,500, or over ten per cent.

Regular gangs of ten men in summer and eight in winter can relay one mile of track in five days, taking out the old steel and can put under and surface one mile of rock ballast in one month, tamping 14 rail lengths in ten hours, or about ten days to a mile. With a proper foreman (the kind $80 a month would supply) one can do without extra gangs en-

tirely. These regular groups would install switches and crossovers, lay steel and stone and maintain a high standard of track excellence.

THE MIDDLE WAY

Some roads make a practice of combining adjacent section crews for particular kinds of work. This is a good idea, which, if overworked, is spoiled. Where all section foremen are competing for the annual prizes, this system takes a man from his own track to help his neighbor. He fears that he is giving another and perhaps a poorer workman the benefit, and the results, of his own ideas and discipline. His neighbor does not want him, as the presence of additional labor on the section detracts from his percentage and record. The men of the visiting gang do not like it, as quitting time finds them too far from home. They regard it as an added hardship without any additional reward, so they make up for it in soldiering.

This method as practiced places a premium on inefficiency and chokes honest effort on the part of the man who really wants to get ahead. It sometimes places a good foreman under the direction of a poorer man and this is galling to an efficient worker. Tools get mixed with resultant bad feeling.

Renewals should be gradual and universal rather than extensive and local. The establishment of permanent regular sections and the abolishment of the extra gangs is but a matter of time. When the railroads cease pursuing the penny-wise, pound-foolish policy of retrenchment in the maintenance department we will have maximum efficiency. The extra gang has its place in the railroad organization, but the end of its day is at hand. It can train the men who are to supervise the permanent sections and then gracefully follow the untreated tie, and the wooden bridge.

UNECONOMICAL TRACK ECONOMY

By G. S. Crites
Southern Pacific, Tucson, Ariz.

It is regrettable that so many American railroads find it necessary to curtail their expenditures for track maintenance in order that they may make some showing in net revenue.

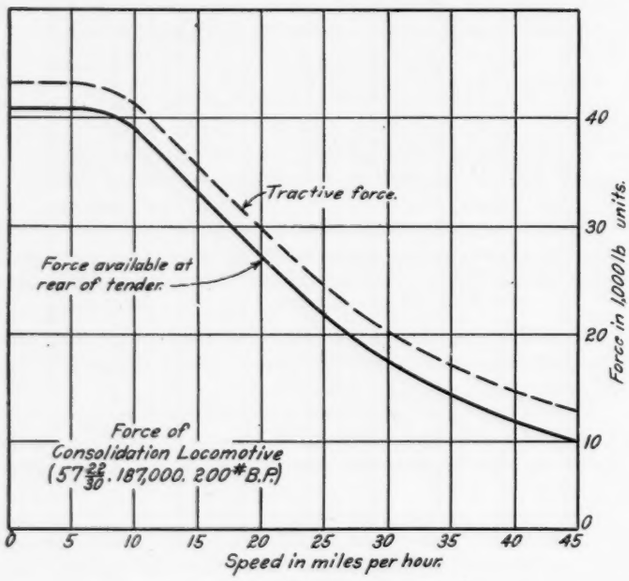

Tractive force.
Force available at rear of tender.
Force of Consolidation Locomotive (57 22/30 . 187,000. 200* B.P.)
Force in 1,000 lb units.
Speed in miles per hour.
0 5 10 15 20 25 30 35 40 45
0 10 20 30 40

Fig. 1

At best, such an expedient is very temporary, and indications are that savings thus obtained are soon absorbed by increased transportation costs brought about by poor track conditions. On poor track much energy is taken up by concussions, damped oscillations, increased flange friction and other causes, and as all energies of a train in motion, except on a down grade, come from the motive power, the loss due to neglected track is a direct pull against net earnings.

Some of the larger systems are securing dynamometer cars, and it is hoped that, thus aided, they will determine the effect of track conditions upon energy expended by the motive power and thereby show the effect of track conditions upon net earnings. Until the results of such tests are known, it would seem desirable to analyze the effect of rough track with the best approximations possible.

The following diagrams show (Fig. 1) the tractive force

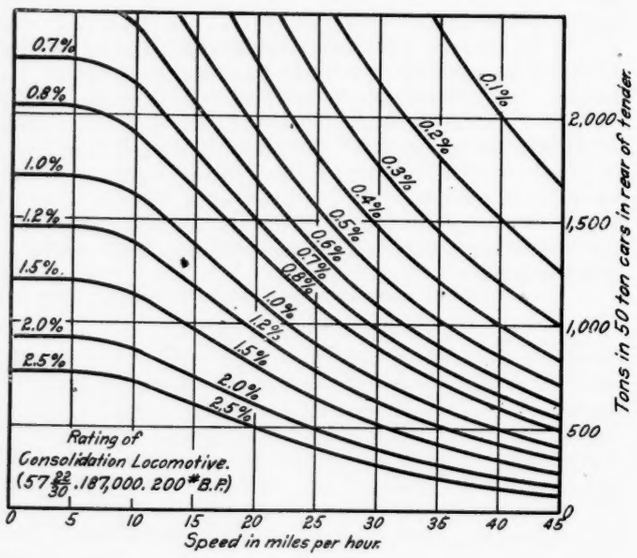


Fig. 2

and available drawbar pull of a consolidation locomotive (Fig. 2), the rating of this locomotive is 50 ton cars (Fig. 3), the velocity head plus head due to rotating parts at various speeds and grades of uniform retardation from such heads and (Fig. 4) the force per 1,000 lb. necessary to acceleration.

Suppose this locomotive, with maximum effort, is hauling 1,200 tons at a speed of 25 miles per hour and encounters a mile of track of such condition that the best that can be

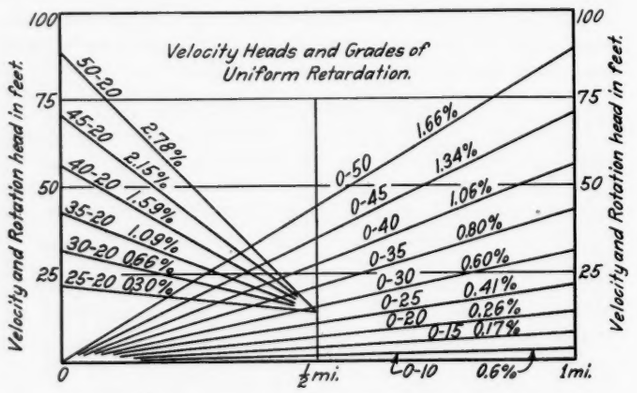


Fig. 3

done is 20 miles an hour. From Fig. 1 it is noted that the engine is exerting 5,600 lb. extra on this mile, consuming 15 h. p. hours. If the speed of 25 miles is regained 11 h. p. hours will be taken up in acceleration. The total loss will approximate 100 lb. of coal and 100 gal. of water.

Again suppose this train finds a slow order out on this piece of track, and reduces speed to 10 miles an hour. From Fig. 3 it is seen that a head of almost 18½ ft. is lost, making

a loss of over 50,000,000 ft. lb. If it picks up its former speed of 25 miles per hour the acceleration will absorb nearly 26 h. p. hours, amounting to about 100 lb. of coal and 100 gal. of water.

It can be seen that many trains on long stretches of weak track will burn much fuel to overcome track resistance. The

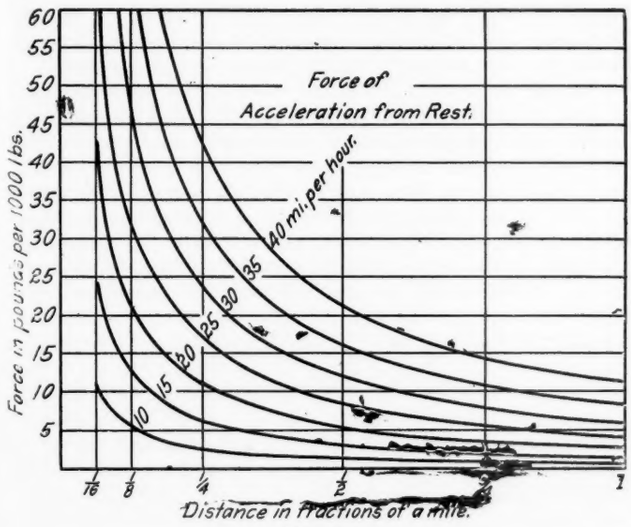


Fig. 4

exact point where the cost of this fuel will equal the money not spent for track maintenance is not known, but judging from the financial showings that have been made by some roads that have skimped on their track repairs, it would seem that good track maintenance pays at all times.

ABSTRACT OF ENGINEERING ARTICLES

The following articles of special interest to engineers and maintenance of way men, and to which readers of this section may wish to refer, have appeared in the *Railway Age Gazette* since June 19, 1914:

Jersey Central Engine Terminal at Communipaw.—The Central Railroad of New Jersey has recently completed a large and unusually complete engine terminal at Communipaw, N. J., to handle the engines entering Jersey City. These facilities were described in an illustrated article in the issue of June 26, page 1585.

The Valuation of Railways.—This subject was discussed in some detail in an article by Logan G. McPherson, lecturer on transportation at Johns Hopkins University, in the issue of June 26, page 1588.

Observations on Finishing Temperatures and Properties of Rails.—A summary of a paper to be published shortly by the Bureau of Standards, prepared by G. R. Burgess, J. J. Crowe, H. S. Rawdon and R. G. Waltenberg, of this bureau, was published in the issue of June 26, page 1592. The investigations reported in this paper are intended to show that the shrinkage clauses commonly found in American rail specifications do not serve their purpose of limiting the finishing temperatures to a value slightly above the critical range.

The Valuation of Railway Property and the Distribution of Earnings and Expenses According to Use.—The railways operating in the state of Oklahoma have recently prepared a formula by which the properties and expenses are divided between states and between "line" and "terminal," while both "line" and "terminal" property and accounts are further subdivided between freight and passenger, and between main and branch line. The apportionment of main and branch line freight and passenger accounts, both "line" and "terminal," are further subdivided between intrastate and interstate. The method by which this was worked out was described in the issue of July 3, page 17.

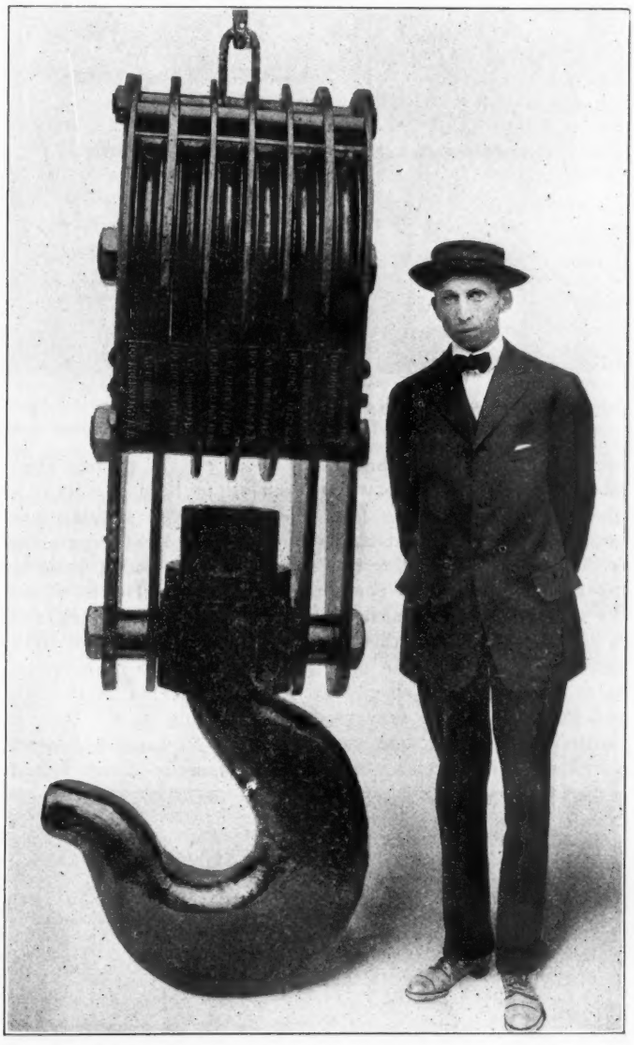
New Pennsylvania Elevator at Philadelphia.—On July 1 the Pennsylvania placed in operation a new reinforced concrete elevator with a storage capacity of 1,000,000 bushels, and a loading capacity of 60,000 bushels per hour. This elevator was described in an illustrated article in the issue of July 3, page 19.

New York Central's Improvements at Utica, N. Y.—The New York Central has been engaged for some time in the construction of a new passenger station and freight houses, and a large classification yard and engine terminal at Utica. The interesting details of the construction of these facilities were described in the issue of July 10, page 47.

A LARGE HOOK BLOCK

A hook block, which is, so far as known, the largest ever built, has recently been constructed for the Illinois Central by the W. W. Patterson Company, Pittsburgh. This block is designed for a working load of 50 tons, with a factor of safety of 3½ and weighs 2,500 lb. This block is provided with a ball-bearing hook which was forged from an 8 in. by 8 in. special billet, which was flattened until it measured 10⅝ in. by 6½ in. This hook and the beam which supports it in the block weigh 1,040 lb. alone.

The block itself is built with strap 8 in. by ⅝ in. by ½ in. plates and ¾ in. plates between the first and second sheaves on each side, which plates support the hook beam. The



A 50-Ton Hook Block Weighing 2,500 Lbs. Complete

inside plates are ½ in. thick. The tail bolt is 2 in. in diameter, the sheave pin 3 in. in diameter, with a ½ in. dog to prevent it from turning, the head bolt is 3 in. in diameter and the lugs of the beam which support the hook are 3½ in. in diameter. Instead of the usual gas pipe separators, this block is provided with four heavy cast iron separators between each pair of plates, making it unusually rigid.

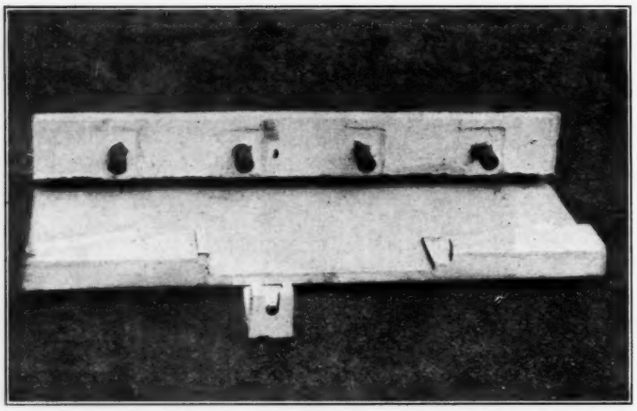
The sheaves are 20 in. in diameter and are ground smooth in the groove for a ⅞ in. wire cable and are bushed with Metaline bushings. The edges of all plates are ground and filed smooth to prevent the cutting of the cable.

This block will be used on a 50-ton Mitchell derrick car

on bridge erection. Although of special design and construction throughout, it was shipped 23 days after the order was placed.

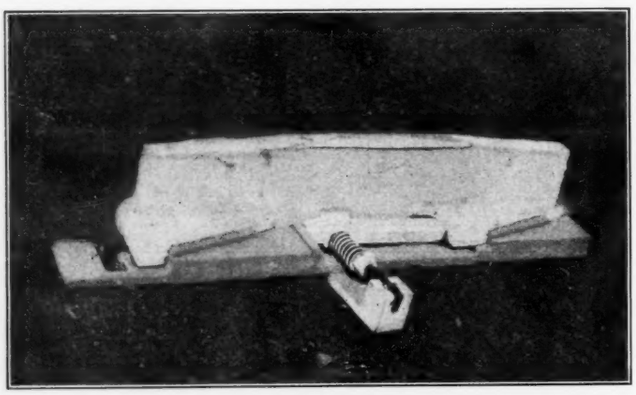
THE AUTOMATIC CONTINUOUS RAIL JOINT

The Automatic Continuous Rail Joint has been under test in a side track of the Chicago & Eastern Illinois at Coaler, Ill., two miles south of Watseka, since last fall, and this road is now making preparations to place others in its No. 4 freight main track near Momence in the very near future. This joint consists essentially of a base plate with an inside angle bar



Base Plate and Inside Angle Bar Section

and lugs to engage the bolt holes in the rail, an outside angle bar and riser, and a pawl and spring to hold the joint in place. In applying the joint the combined base plate and angle bar is inserted under the rail. The other angle bar is then placed in position and driven endwise until the wedging action brings it in contact with the rail. The pawl and the spring hold the joint in place, as shown in the photograph. It is claimed that in this manner the joint is always tight, eliminating the expense and attention required to keep the bolts tight, that the riser prevents the battering of the rail, and that the joint is prevented from opening by the lugs on the inner angle bar. As installed in the Chicago & Eastern



View of Complete Joint in Place

Illinois tracks, the joint is 26 in. long and weighs 100 lb. While in the side track these joints have been carrying the heavy Mikado engines of the Chicago & Eastern Illinois and the Elgin, Joliet & Eastern, drawing tonnage coal trains at speeds up to 10 to 15 miles per hour, and are reported to have required no maintenance in this interval. This joint has been patented and is made by Charles Troup, Watseka, Ill.

TWO METHODS OF TRAINING SECTION FOREMEN

The problem of securing a sufficient number of capable section foremen is common to nearly all roads, and is the subject of much study and thought. As a result several plans have been tried out experimentally on different roads. On the eastern roads this problem is especially urgent because of the almost complete absence of native laborers in the gangs.

To alleviate this condition one eastern road has inaugurated a plan whereby assistant foremen are selected from outside industries. The standard rate of pay for section laborers is $0.175 per hour. A rate of $0.215 has been established for assistant foremen, and one such man is allotted to each section gang. In putting the plan into effect, each section foreman was instructed to secure a promising native man in his vicinity and was authorized to pay him the higher rate at once. All men were selected under the supervision of the supervisor. This man started work with the other laborers, doing the same tasks required of them, but was given more opportunity to develop into a foreman. After he has shown sufficient progress, he is made an assistant foreman of an extra gang at $65 a month, where he has an opportunity to learn the details of switch work, ballasting, rail laying, etc. The assistant foremen of the extra gangs are called on to take the places of section foremen temporarily when they are absent from work because of sickness or other reasons and are eligible for promotion to the position of regular section foreman as vacancies occur.

While it has been the practice on this road to draw the section foremen from assistant extra gang foremen for five or six years, the part of the plan relating to assistant section foremen has been in effect for only 1½ years. It is too early to observe the full results of this plan at the present time, but one noticeable condition is that 12 sons of section foremen have already secured positions as assistant foremen, whereas, previously, it was the almost universal practice for foremen to encourage their sons to go into other lines of industry. Also, while it was supposed that the bonus of $0.04 per hour paid the inexperienced assistant foremen would be lost at first, the officers in charge of this experiment believe that the pace set by these men has stimulated the gangs sufficiently to make the higher rate worth while from the start. The main advantage, of course, is that this road now has a sufficient supply of men capable of promotion to the positions of foremen. In one instance 10 extra gangs were put on because of a large amount of work at one important terminal and all of the foremen for these gangs were secured from the ranks of these apprentice foremen.

However, believing that the day is not far distant when the railways will be unable to secure sufficient native foremen with these inducements, and that the roads must rely upon foreign foremen, this road has recently organized two night schools, one for Italians and one for Slavs, with an attendance of about 30 men each. These students are recruited from the track gangs, and they meet two nights each week in an old passenger car which is provided by the railway company. A course covering two years has been arranged, at the end of which it is expected that the men will have acquired a sufficient knowledge of English to handle the routine work required of them as section foremen. The first course consists of 15 lessons in English, which is followed by an elementary commercial course and then by 17 lessons in track work. This work is being handled in connection with the assistance of the Y. M. C. A., which is providing the teachers. The only cost to the men is $0.02 per lesson to pay for the stationery. The two classes already organized are now starting the track course. It is planned to extend this work to other points as fast as sufficient interest is aroused among the men.

PROGRESS OF THE BAGDAD RAILWAY IN ASIA MINOR.—Another section of the Bagdad Railway from Jerablus, on the Euphrates, to Tel Abiad, about 60 miles to the east, was opened on July 1.

General News Department

The strike at the Westinghouse Works at East Pittsburgh was called off July 9 and it was voted to return to work July 13. Large numbers of the men returned on the 10th and 11th.

Nicholas Roginsky and W. Landburg, officers of the Moscow-Kazan Railway, are inspecting the automatic block signals on the Lehigh Valley. Mr. Landburg is assistant to the chief traffic manager and Mr. Roginsky is assistant to the chief of the telegraph department.

The moving picture promoters have revived an American industry which had long been languishing—show collisions for the amusement of crowds. Such a collision of locomotives was produced at Wharton, N. J., last Sunday and 2,000 persons are said to have witnessed it. The engines collided on a trestle about 50 ft. above the ground. One of the engines was knocked off, and when it struck the ground there was an explosion which wrecked it. The engines were old ones, owned by the Wharton Iron & Steel Company.

A train on the Missouri, Kansas & Texas was stopped by robbers near Matson, Mo., on the night of July 9 and the express car and mail car, after having been detached and run forward some distance, were robbed of their valuables. The safe in the express car was blown open. Three masked men stopped a train of the Oregon-Washington Railroad & Navigation Company near Pendleton, Ore., July 2, subdued the trainmen and proceeded to rob the passengers; but Deputy Sheriff McDuffey, who was in one of the coaches, fired at the robbers and killed one of them. McDuffey, himself, was wounded and one of the robbers was wounded, but he and his uninjured companion got away.

Officers of the engineers' and firemen's brotherhoods representing the men employed on the roads west of and including the Illinois Central renewed their conferences concerning their demands for increased wages and changes in working conditions with a committee of general managers, headed by A. W. Trenholm (Chicago, St. Paul, Minneapolis & Omaha), at Chicago on July 14. Since negotiations were broken off early in June the men have taken a strike vote. On presenting the result of the strike vote to the committee of managers, the brotherhood committee gave the newspapers a long statement in which they said that they would reject any proposition to arbitrate. The managers' committee asked for a detailed statement of the strike vote.

Application has been made to the Federal District Court at Dallas, Tex., by J. W. Robbins, receiver and president of the Trinity & Brazos Valley, for permission to cancel certain trackage agreements with five other railroads because they are unprofitable. These are as follows: Missouri, Kansas & Texas, between Dallas and Waxahachie. For the use of this track the Trinity & Brazos Valley pays an annual rental of $24,000. Chicago, Rock Island & Gulf, Fort Worth to Dallas. Annual rental paid by the T. & B. V. is $60,000. Gulf, Colorado & Santa Fe, Fort Worth to Cleburne and Houston and Galveston. The T. & B. V. pays $48,000 annually. Galveston Terminal, Houston to Galveston. The T. & B. V. pays $72,000 annually. Dallas Terminal and Dallas Union Depot, trackage rights in the city of Dallas. Rental $6,825 annually.

Railway Mail Pay

In reference to the publication yesterday of a report from Washington that the House Committee on Post Offices had taken action designed to increase the allowance made railways for the transportation of the mails, Ralph Peters, chairman of the Committee on Railway Mail Pay, authorized the following statement:

"The bill introduced by Congressman Moon had proposed to reduce the railway mail pay at least $3,000,000 below what had already been appropriated for this fiscal year. The amendment apparently made to the Moon bill merely provides for the restoration of substantially the $3,000,000 by which it had been proposed to cut the pay.

"The railroads have contended and they still insist that they are already underpaid at least $15,000,000 a year. Congress now has at work a bi-partisan commission investigating the question of fact as to whether the railroads are or are not underpaid for this service. It is obviously impossible to properly consider a readjustment until the question of fact has been established.

"The railroad committee believes, therefore, that in justice to the railroads and in justice to the public the report of the joint Congressional commission should be awaited. The railroads are confident that that report will submit a finding on the main question of fact, which will be fair to all concerned.

"When that report is submitted and the question of fact is determined, the railroads' committee will be prepared to cooperate with the government in developing a method of readjusting the underpayments or overpayments in such a manner that the interests of all may be properly protected."

Preliminary Valuation Work

The following is the text of the Interstate Commerce Commission valuation circular No. 1:

At the meeting between the engineers of the commission and the committee of railway engineers on February 26, 1914, there seemed to be some uncertainty in the minds of the railway people as to exactly what should be done first in preparing upon their part for the work of valuation. This circular is issued for the purpose of explaining that matter, and has been delayed owing to conferences with the committee of railway presidents touching methods of co-operation.

All carriers having reason to believe that their maps and profiles already in existence will be received under the order effective February 1, 1914, pertaining to specifications for maps and profiles, should at once assemble such maps for inspection. It is not necessary in case of systems of considerable extent that all maps and profiles should be brought together at one point, when this would involve undue labor upon the part of the carrier, but it is indispensable that they should be put into such orderly shape that they can be seen and readily examined.

As soon as the maps and profiles are ready for inspection, the commission should be notified of the place or places where they are and should be requested to make the examination. This will be done as promptly as the work of the commission permits, and when several carriers are awaiting examination at the same time the commission will first act in case of those carriers whose property is to be first valued.

Ordinarily the commission will give at least three months' notice of its intention to begin work upon the property of a given carrier, and it will, so far as may properly be done, consult the reasonable convenience of the carrier in the prosecution of the work. Carriers desiring to obtain copies of cross section and chaining notes, with which to complete their maps and profiles, thereby avoiding a duplication of work, may do so by expressing their willingness to sign the agreement, copy of which is printed at the foot of this circular, at the time they give written notice that their maps are ready for examination.

As soon as the commission has passed upon the maps and profiles, the carrier should proceed to make the changes or additions required in present maps and profiles or to prepare new ones, as the case may be. Carriers having no maps and profiles, or whose maps and profiles are clearly of such a character as to be insufficient for this work, should at once proceed to prepare those called for by the order of the commission. In doing this the requirements of that order must be strictly followed with respect to right of way and station maps. Carriers may, if they elect, prepare a tentative profile, omitting the vertical projection of the original ground surface, but showing the subgrade and giving information as to structures called for in subdivision (b), paragraph 17, of the order of the com-

REVENUES AND EXPENSES OF RAILWAYS

MONTH OF MAY, 1914.

Name of road.	Average mileage operated during period.	Operating revenues			Operating expenses						Net operating revenue (or deficit).	Outside operations, net.	Taxes.	Operating income (or loss).	Increase (or decr.) comp. with last year.
					Maintenance										
		Freight.	Passenger.	Total. inc. misc.	Way and structures.	Of equipment.	Traffic.	Transportation.	General.	Total.					
Atlantic City	167	$65,643	$141,628	$216,003	$39,616	$18,192	$1,838	$78,029	$992	$138,567	$77,436	—$3,089	$15,000	$59,347	$25,763
Central of New Jersey	676	1,761,187	470,919	2,306,450	316,004	405,001	26,591	754,126	49,923	1,551,645	754,805	—32,702	111,838	610,265	—106,181
Chesapeake & Ohio Lines	2,347	2,341,716	511,549	2,994,832	399,795	645,078	58,151	1,018,684	88,712	2,210,420	784,412	11,273	120,671	675,014	—99,828
Ft. Worth & Denver City	454	198,515	99,181	318,648	53,312	45,215	7,903	145,631	15,304	267,365	51,283	—825	13,300	37,158	—58,597
Georgia	307	137,926	72,127	229,576	28,884	48,135	13,714	107,084	8,467	206,284	23,292	.....	2,566	20,726	—5,891
Mobile & Ohio	1,122	908,134	123,043	1,085,279	123,887	232,390	45,083	427,398	34,647	863,405	221,874	—2,988	36,597	182,289	—108,716
Pere Marquette	2,322	854,672	267,587	1,241,350	457,275	*2,681,904	35,622	602,482	52,352	3,829,635	—2,588,285	—102,820	56,577	—2,747,682	—2,956,216
Philadelphia & Reading	1,020	3.158,981	593,820	3,934,622	535,800	695,921	45,019	1,301,227	69,931	2,647,898	1,286,724	64,477	102,753	1,248,448	—330,815
Port Reading	21	108,836	.....	120,698	14,647	2,088	38	33,722	104	50,599	70,099	6,043	19,000	57,142	—32,423
St. Louis & San Francisco	4,742	2,020,635	845,886	3,113,180	900,044	412,765	80,540	1,211,920	100,590	2,705,859	407,321	.....	117,039	290,282	—497,619
Southern in Mississippi	281	47,365	30,457	84,990	25,846	8,580	2,792	41,798	4,138	83,154	1,836	.....	7,750	—5,914	20,938
Texas & Pacific	1,885	930,951	351,075	1,373,944	211,301	256,744	35,428	645,014	44,078	1,192,565	181,379	—2,271	62,000	117,108	86,369
Toledo, St. Louis & Western	451	292,300	28,508	347,697	37,996	34,363	16,360	132,268	9,322	230,309	117,388	.....	19,500	97,888	—34,836
Ulster & Delaware	129	68,051	24,224	96,543	9,439	8,993	3,183	38,246	4,183	64,044	32,499	—56	2,500	29,943	9,870
Wabash	2,515	1,545,625	562,332	2,304,225	435,624	454,123	79,726	987,674	69,219	2,026,366	277,859	—3,445	99,192	175,222	—242,755
Western Maryland	661	560,513	75,014	669,382	181,170	266,323	21,598	273,845	20,218	763,154	—93,772	.....	24,500	—118,272	—250,191
Western Pacific	943	331,540	100,477	447,397	117,499	65,405	27,660	157,209	20,684	388,457	58,940	—2,468	34,871	21,601	—86,956

ELEVEN MONTHS OF FISCAL YEAR ENDING JUNE 30, 1914

Name of road.	Average mileage operated during period.	Operating revenues			Operating expenses						Net operating revenue (or deficit).	Outside operations, net.	Taxes.	Operating income (or loss).	Increase (or decr.) comp. with last year.
					Maintenance										
		Freight.	Passenger.	Total. inc. misc.	Way and structures.	Of equipment.	Traffic.	Transportation.	General.	Total.					
Atlantic City	167	$694,034	$1,311,040	$2,118,447	$416,494	$153,354	$28,374	$1,054,586	$14,885	$1,667,693	$450,754	—$33,470	$129,000	$288,284	$31,078
Central of New Jersey	676	18,998,101	5,100,114	25,008,262	2,974,753	4,276,629	342,771	8,077,461	507,493	16,179,107	8,829,155	—77,661	1,224,308	7,527,186	—2,245,930
Chesapeake & Ohio Lines	2,344	26,444,637	5,569,738	33,528,862	3,694,693	7,156,311	610,376	11,143,967	852,199	23,457,546	10,071,316	26,915	1,266,465	8,831,766	478,194
Fort Worth & Denver City	454	2,838,349	1,335,290	4,407,618	545,982	670,888	78,364	1,830,925	172,970	3,299,129	1,108,489	—5,828	169,153	933,508	—487,230
Georgia	307	2,018,107	850,067	3,089,287	307,395	534,973	130,124	1,371,553	96,959	2,441,004	648,282	.....	30,048	618,234	288,990
Mobile & Ohio	1,122	9,808,870	1,401,897	11,895,402	1,387,142	2,444,756	461,275	4,568,517	368,306	9,229,996	2,665,406	—17,833	385,369	2,262,204	—408,498
Pere Marquette	2,322	10,250,967	3,594,416	15,189,072	2,586,385	*6,070,363	378,122	6,723,493	470,476	16,228,839	—1,039,767	—125,690	580,257	—1,745,714	—4,736,464
Philadelphia & Reading	1,020	34,976,356	6,427,760	43,423,190	4,639,573	8,038,919	478,421	15,004,577	723,098	28,884,588	14,538,602	321,390	1,129,508	13,730,484	—4,210,904
Port Reading	21	1,205,861	.....	1,248,223	149,464	4,327	428	417,115	3,824	575,158	673,065	41,236	155,000	559,301	—392,124
St. Louis & San Francisco	4,742	26,585,749	9,881,405	39,208,316	6,672,460	6,510,988	802,326	13,571,157	1,113,343	28,670,274	10,538,042	.....	1,298,309	9,239,733	—2,872,515
Southern in Mississippi	281	705,397	405,857	1,205,929	272,219	117,464	27,632	506,029	44,719	968,063	237,866	.....	93,114	144,752	152,601
Texas & Pacific	1,885	11,898,678	4,308,431	17,381,259	2,092,380	2,714,411	412,477	7,474,665	477,443	13,171,376	4,209,883	—40,120	668,541	3,501,222	846,293
Toledo, St. Louis & Western	451	3,588,397	334,990	4,191,901	433,644	554,800	180,850	1,631,290	101,782	2,902,366	1,289,535	.....	185,000	1,104,235	—66,701
Ulster & Delaware	129	596,818	315,617	963,164	129,297	136,279	17,384	429,900	43,789	756,649	206,515	444	37,500	169,459	—68,921
Wabash	2,515	18,659,855	6,593,090	27,684,839	3,558,819	5,193,574	933,088	11,812,909	764,133	22,262,523	5,422,316	—53,160	945,118	4,424,038	—1,326,539
Western Maryland	661	6,283,788	934,054	7,556,588	1,399,031	1,688,793	256,519	3,531,802	233,787	7,109,932	446,656	.....	236,100	210,556	—1,207,855
Western Pacific	939	4,303,502	1,128,800	5,588,133	1,219,162	740,622	307,717	2,070,374	278,843	4,616,718	971,415	—25,048	365,839	580,528	—689,290

*Depreciation for back years included.

mission, except that the location of these structures need not be stated with absolute accuracy. Blue prints of this tentative profile shall be furnished the commission and the information obtained by the surveys of the commission may be subsequently utilized by the carrier in completing the profiles as called for by said order.

All carriers should at once prepare a list of their lands, showing grantor, grantee, instrument, etc., as called for in the order. If the carrier prefers, it may in the first instance prepare typewritten schedules which may be so arranged upon separate sheets as to be mechanically transferred to the maps finally. In the end the schedule of lands must appear upon the map as set forth in the order pertaining to maps and profiles.

Roads which have a gross income not exceeding $100,000 annually are excused for the time being from preparing this information. It is possible that the present order may be modified in some respects as to such railroads, and if so, due notice will be given. If no such change has been noted by October 1, 1914, such railroads should prepare to comply with the order of the commission as it now stands.

It should be noted that this circular does not of itself modify the order of January 12, 1914, but simply indicates those modifications which may be made by the commission in due time upon application.

Topics for Next International Railway Congress*

Section I.—Way and Works

I.—Construction of the Roadbed and of the Track.—Arrangements to be adopted in constructing the roadbed and the track, in view of the increase in the weight of locomotives and the speed of trains. *America.*—H. U. Mudge, president, Chicago, Rock Island & Pacific.

II.—Maintenance and Supervision of Track.—Measures to be taken to provide an economic organization for the maintenance and the supervision of the track, taking into consideration the increase of traffic and speed as well as the rise in wages and in the cost of materials. Use of mechanical appliances. Results obtained. *America.*—Epes Randolph, president, Southern Pacific of Mexico.

III.—Special Steels.—Use of special steels, both for the track generally and in particular for the track appliances (points, crossings, etc.). *America.*—W. C. Cushing, chief engineer M. W., Pennsylvania Lines.

IV.—Reinforced Concrete.—Use of ordinary concrete and of reinforced concrete on railways. *America.*—C. H. Cartlidge, bridge engineer, Chicago, Burlington & Quincy.

Section II.—Locomotives and Rolling Stock

V.—(I. of Section 2)—Economic Production of Steam on Locomotives.—Economic production of steam; different systems; results obtained: *(A)* Superheating the steam; *(B)* heating the feed-water; *(C)* special devices; water-tube boilers, etc. *Countries Using the English Language.*—G. J. Churchward, chief mechanical engineer, Great Western Railway of England.

VI. (II. of Section 2)—Trucks, Axles and Springs of Locomotives.—Best arrangement of the bogies, axles and springs of locomotives, especially of locomotives for high speeds, with long wheel bases, so as to facilitate running around curves and to ensure the proper stability of the engines. No American reporter.

VII. (III. of Section 2)—Passenger Carriages.—Improvements to be made in the design of carriages and rules to be observed in the makeup of trains, so as to increase the safety and comfort of passengers. *America.*—B. F. Bush, president, Missouri Pacific.

VIII. (IV. of Section 2)—Electric Traction.—Electric traction on lines with much traffic; production and transmission of energy; type of current; locomotives, motor cars. Technical and financial results obtained. Comparison with the results of steam traction. *America.*—George Gibbs, chief engineer of electric traction, Long Island Railroad.

Section III.—Working

IX. (I. of Section 3)—Terminal Stations for Passengers.—Arrangements for reducing the number of movements of locomotives and empty rolling stock at passenger terminal stations. *America.*—(Vacancy).

X. (II. of Section 3)—Goods (Freight) Stations.—Organization of the receiving and the delivering stations so as to accelerate their business. Arrangement of the buildings and tracks so as to simplify shunting (switching) operations and handling, particularly as regards goods in bulk. Mechanical appliances. *America.*—Howard G. Kelley, vice-president, Grand Trunk.

XI. (III. of Section 3)—Slow Freight Traffic.—Organization of slow freight traffic, in order to increase the effective operation of the rolling stock and the lines. Advisability of using, according to circumstances, heavy or light trains, fast or slow trains. Through trains. Pick-up trains (distributing trains). Shuttle services. *Countries Using the English Language.*—H. A. Walker, general manager, London & South Western.

XII. (IV. of Section 3)—Locomotive Cab Signals.—Repeating and recording the track signals on the locomotive. Different systems already used or tried. Results obtained. Recording the running speed of locomotives. No American reporter.

Section IV.—General

XIII. (I. of Section 4)—Net Cost Rates.—Determination of the net cost of carriage (passengers and goods), taking capital charges into consideration. Its relation to rates charged. *America.*—Fairfax Harrison, president, Southern Railway.

XIV. (II. of Section 4)—Customs Examination.—Organization to be adopted for the customs examination of luggage so as to reduce to a minimum the inconvenience to passengers, while safeguarding the interests of the custom house and of the railway. Establishment of international custom house stations. No American reporter.

XV. (III. of Section 4)—Interchange of Rolling Stock.—Interchange of goods rolling stock (freight cars), and penalty charges in case of delay in the return of that stock: *(A)* Rules to be adopted in the relations between the railways themselves; *(B)* rules to be adopted in the relations between the railways and the consignors and consignees. *America.*—Arthur Hale, general agent, American Railway Association.

XVI. (IV. of Section 4)—Workmen's Dwellings.—How is the problem of dwellings for their workmen and lower-grade employees solved by the railways? How do the administrations assist the individual efforts made by the staff, in particular as regards the building of dwellings for the use of laborers and employees? *America.*—A. F. Banks, president, Elgin, Joliet & Eastern.

Section V.—Light Railways

XVII. (I. of Section 5)—Carriages and Wagons for Light Railways.—Types of carriages and of wagons for narrow-gage railways. Special wagons for facilitating unloading, transshipment and change of gage. No American reporter.

XVIII. (II. of Section 5)—Simplifications in the Operation of Light Railways.—General simplifications to be considered in the operation of light railways. Special methods for collecting fares; issue of tickets at booking offices, before starting; issue on the trains; different types of tickets; auditing systems. No American reporter.

XIX. (III. of Section 5)—Special Methods of Traction on Light Railways.—Special methods of traction applied on light railways. Results obtained. *America.*—H. B. Spencer, vice-president, Southern Railway.

XX. (IV. of Section 5)—Safety Appliances on Light Railways.—Cheap appliances for ensuring safety on light railways. No American reporter.

*The International Railway Congress Association will meet next at Berlin, Germany, in 1915. The questions to be discussed are given in the list here printed, together with the names of American authors of papers.

International Railway General Foremen's Association

The following is a list of the exhibitors at the convention of the International Railway General Foremen's Association held at the Hotel Sherman, Chicago, on July 14 to 17:

Allen & Co., Edgar, Ltd., Chicago—High speed steel.

American Car & Foundry Company, Chicago. Represented by O. F. Schubert and Mr. Spears.

American Steel Foundries Company, Chicago.—American adjustable pilot coupler pocket with Alliance coupler, Vulcan cast steel truck, Vulcan and Hercules brake beams, Economy draft arms. Represented by H. J. Melchert and W. G. Wallace.

Ashton Valve Company, Boston, Mass.—Locomotive safety valves; steam, air and test gages; wheel pressed recording gage, gage testers and appliances. Represented by Jos. F. Gettrust.

Barco Brass & Joint Company, Chicago.—Flexible joints, roundhouse blower sets and washout connections. Represented by F. N. Bard and C. L. Mellor.

Carborundum Company, Niagara Falls, N. Y.—Carborundum and aloxite wheels and aloxite and carborundum cloths and valve grinding compounds. Represented by C. C. Schumaker, H. P. Frost and E. P. Ritzina.

Celfor Tool Company, Buchanan, Mich.—Drills, reamers, flue cutters, boring tools, etc. Represented by C. O. Montague.

Chicago Pneumatic Tool Company, Chicago.—Air and electric drills, pneumatic hammers, speed recorders. Represented by C. E. Walker, P. F. Flaven, J. C. Campbell, J. L. Camby, C. B. Coates and Chas. H. Schumasken.

Colonial Steel Company, Pittsburgh, Pa.—High speed saws, drill rods, 11/16 in. punch shown through 1⅛ in. steel, examples of steel fractures, photographs. Represented by T. W. McManus and M. P. Spencer.

Crerar, Adams & Co., Chicago.—Jacks, die starters, pipe benders, wrenches. Represented by Russel Wallace and W. I. Clock.

Crucible Steel Company of America, Pittsburgh, Pa. Represented by Mr. Baskerfield.

Detroit Lubricator Company, Detroit, Mich.—Lubricators. Represented by A. D. Homard and A. G. Machaney.

Duff Manufacturing Company, Pittsburgh, Pa. Represented by Geo. A. Edgin and Chas. N. Thulin.

Edna Brass Manufacturing Company, Cincinnati, Ohio.—Lubricators, injectors. Represented by H. A. Glenn and E. O. Corey.

Ewald Iron Company, St. Louis, Mo.

Flannery Bolt Company, Pittsburgh, Pa.—Tate flexible staybolt. Represented by R. R. Davis.

Galena Signal Oil Company, Franklin, Pa. Represented by W. J. Walsh and Bloss P. Corey.

Garlock Packing Company, Palmyra, N. Y.—Throttle, car cock and air pump packing. Represented by J. P. Landreth.

Goldschmidt Thermit Company, New York.—Thermit welding compounds and sample welds. Represented by H. S. Mann and A. Beaulieu.

Greene, Tweed & Co., New York.—"Palmetto" packings, "Manhattan" packings. Represented by A. T. Richardson.

Grip Nut Company, Chicago.—Testing machines, deflecting machines, samples grip nuts. Represented by B. C. Hooper.

Hunt-Spiller Manufacturing Corporation, Boston, Mass.—Gray irons for cylinder bushings, packing valve gages, boxes, etc. Represented by J. M. Mourse and E. J. Fuller.

Independent Pneumatic Tool Company, Chicago.—New electric tools, new air turbines, small S. S. compound drills. Represented by Robert T. Scott, George Wilson, Harold Henricks and Wm. Gummere.

Jenkins Bros., New York.—Globe, angle Y and check valves, standard medium pressure and extra heavy gates. Represented by B. J. Neely.

Jones & Co., B. M., Boston, Mass. Represented by J. M. Moore.

Keystone Lubricator Company, Philadelphia, Pa.—Model driving box. Represented by J. W. Mowery.

Locomotive Superheater Company, New York.—Boiler tools and unit distributing Prosser gages. Represented by G. E. Ryder and Geo. Fogg.

Lutz-Webster Engineering Company, Philadelphia, Pa.—Lutz no-set screw lathe dog, Lutz no-handle ratchet, Lutz one-piece drill ratchet, Lutz adjustable self-feed drilling post—solid and swivel arm, Lutz compression wrench for all finished or rough surfaces—stud driving. Represented by William H. Lutz.

McCord & Co., Chicago.—Model McCord force feed lubricator, pressed steel journal box. Represented by O. H. Neal.

Manning, Maxwell & Moore, Inc.; Ashcroft Manufacturing Company; Consolidated Safety Valve Company; The Hancock Inspirator Company, New York.—Hancock inspirators, boiler checks, Consolidated safety valves, Ashcroft pressure gages, prismatic water glasses and other locomotive appliances. Represented by C. L. Brown.

Miner, W. H., Chicago. Represented by John R. Mitchell.

M. C. B. Company, Chicago. Represented by W. E. Marvel.

Nathan Manufacturing Company, New York. Lubricators, water glasses and valves. Represented by George Royal.

National Machinery Company, Tiffin, Ohio.—Single motor driven bolt cutter and die sharpener. Represented by Chas. Harmon, Jr., and K. L. Ernst.

National Boiler Washing Company, Chicago.

Ohio Injector Company, Detroit, Mich.—Injectors, lubricators, flange oilers and boiler fittings. Represented by Wm. S. Furry and A. C. Beckwith.

Okadee Company, Chicago.—Blow-off valves, water gage, tender hose coupler drain valve. Represented by A. G. Hollingshead, M. E. Keig and G. S. Turner.

O'Malley-Beare Valve Company, Chicago.—Multiplate, Globe, angle, check and blowout valves. Represented by E. O'Malley and Thos. O'Malley.

Pilliod Company, The, New York.—Model Baker valve gear, photographs of installations. Represented by F. S. Wilcoxen, F. E. Pilliod and R. G. Graham.

Pyle-National Electric Headlight Company, Chicago.—Electric headlight. Represented by Crawford P. McGinnis.

Racine Tool and Machine Company, Racine, Wis.—High speed metal cutting machines. Represented by J. M. Jones and Wm. Reinhardt.

Rich Tool Company, Chicago.—High speed tool. Represented by O. F. Schubert.

Ryerson, Joseph T., & Son, Chicago.—Model of a punch and boiler tools. Represented by L. H. Bryan, C. R. Gregg, H. C. Williamson and H. G. Merriell.

Strong-Carlisle & Hammond Company, Cleveland, Ohio.—Randall graphite sheet lubricator, Mac-it set screws. Represented by B. E. Carpenter.

United States Metallic Packing Company, Philadelphia, Pa.—Packings, Leach improved bi trap, Gollmar bell ringers, catalogs. Represented by W. M. Wey.

Westinghouse Air Brake Company, Pittsburgh, Pa. Represented by L. M. Carlton, L. Wilcox and A. K. Hohinyer.

Wilhelm Safety Automatic Coupler Company, The, Chicago.—Model air hose coupler. Represented by S. Wilhelm and B. Loewenthal.

Williamson, H. C., Chicago.—Metal band saw. Represented by H. C. Williamson.

MEETINGS AND CONVENTIONS

The following list gives names of secretaries, dates of next or regular meetings, and places of meeting.

Air Brake Association.—F. M. Nellis, 53 State St., Boston, Mass. Next convention, May 5-8, 1915, Hotel Sherman, Chicago.

American Association of Demurrage Officers.—A. G. Thomason, Boston, Mass.

American Association of Dining Car Superintendents.—H. C. Boardman, D. L. & W., Hoboken, N. J. Next convention, October, Washington.

American Association of General Passenger and Ticket Agents.—W. C. Hope, 143 Liberty St., New York.

American Association of Freight Agents.—R. O. Wells, I. C. R. R., East St. Louis, Ill.

American Association of Railroad Superintendents.—E. H. Harman, Room 101, Union Station, St. Louis, Mo. Next convention, August 20 and 21, New York.

American Electric Railway Association.—E. B. Burritt, 29 W. 39th St., New York. Annual convention, October 12-16, Atlantic City, N. J.

American Electric Railway Manufacturers' Association.—H. G. McConnaughy, 165 Broadway, New York. Meetings with American Electric Railway Association.

American Railway Association.—W. F. Allen, 75 Church St., New York.

American Railway Bridge and Building Association.—C. A. Lichty, C. & N. W., Chicago. Next convention, October 20-22, 1914, Los Angeles, Cal.

American Railway Engineering Association.—E. H. Fritch, 900 S. Michigan Ave., Chicago. Next convention, March 16-18, 1915.

American Railway Master Mechanics' Association.—J. W. Taylor, Karpen Bldg., Chicago.

American Railway Tool Foremen's Association.—A. R. Davis, Central of Georgia, Macon, Ga. Next convention, July 20-22, Hotel Sherman, Chicago.

American Society for Testing Materials.—Prof. E. Marburg, University of Pennsylvania, Philadelphia, Pa.

American Society of Civil Engineers.—Chas. W. Hunt, 220 West 57th St., New York; 1st and 3d Wednesday, except June, July and August, New York.

American Society of Engineering Contractors.—J. R. Wemlinger, 11 Broadway, New York; 2d Thursday of each month, at 2 P. M., 11 Broadway, New York.

American Society of Mechanical Engineers.—Calvin W. Rice, 29 W. 39th St., New York.

American Wood Preservers' Association.—F. J. Angier, B. & O., Baltimore, Md. Next convention, January 19-21, 1915, Chicago.

Association of American Railway Accounting Officers.—E. R. Woodson, 1300 Pennsylvania Ave., Washington, D. C. Annual convention, April 28, 1915, Atlanta, Ga.

Association of Railway Claim Agents.—C. W. Egan, B. & O., Baltimore, Md.

Association of Railway Electrical Engineers.—Jos. A. Andreucetti, C. & N. W. Ry., Chicago. Annual convention, October 19-23, Chicago.

Association of Railway Telegraph Superintendents.—P. W. Drew, 112 West Adams St., Chicago.

Association of Transportation and Car Accounting Officers.—G. P. Conard, 75 Church St., New York.

Association of Water Line Accounting Officers.—W. R. Evans, Chamber of Commeree, Buffalo, N. Y.

Bridge and Building Supply Men's Association.—L. D. Mitchell, Detroit Graphite Co., Chicago, Ill. Meeting with American Railway Bridge and Building Association.

Canadian Railway Club.—James Powell, Grand Trunk Ry., Montreal, Que.; 2d Tuesday in month, except June, July and August, Windsor Hotel, Montreal.

Canadian Society of Civil Engineers.—Clement H. McLeod, 176 Mansfield St., Montreal, Que.; 1st Thursday, October, November, December, February, March and April, Montreal.

Car Foremen's Association of Chicago.—Aaron Kline, 841 Lawler Ave., Chicago; 2d Monday in month, except July and August, Lytton Bldg., Chicago.

Central Railway Club.—H. D. Vought, 95 Liberty St., New York; 2d Friday in January, May, September and November and 2d Thursday in March, Hotel Statler, Buffalo, N. Y.

Civil Engineers' Society of St. Paul.—Edw. J. Dugan, P. O. Box 654, St. Paul, Minn.; 2d Monday, except June, July, August and September, Old State Capitol Bldg., St. Paul.

Engineers' Society of Pennsylvania.—Edw. R. Dasher, Box 75, Harrisburg, Pa.; 1st Friday after 10th of each month, except July and August, 31 So. Front St., Harrisburg, Pa.

Engineers' Society of Western Pennsylvania.—Elmer K. Hiles, Oliver Bldg., Pittsburgh; 1st and 3d Tuesday, Pittsburgh, Pa.

Freight Claim Association.—Warren P. Taylor, Richmond, Va.

General Superintendents' Association of Chicago.—A. M. Hunter, 605 Grand Central Station, Chicago; Wednesday preceding 3d Thursday, Transportation Bldg., Chicago.

International Railway Congress.—Executive Committee, 11, rue de Louvain, Brussels, Belgium. Convention, 1915, Berlin.

International Railway Fuel Association.—C. G. Hall, 922 McCormick Bldg., Chicago.

International Railway General Foremen's Association.—Wm. Hall, 829 West Broadway, Winona, Minn.

International Railroad Master Blacksmiths' Association.—A. L. Woodworth, Lima, Ohio. Next convention, August 18-20, Hotel Wisconsin, Milwaukee, Wis.

MAINTENANCE OF WAY & MASTER PAINTERS' ASSOCIATION OF THE UNITED STATES AND CANADA.—T. I. Goodwin, C. R. I. & P., Eldon, Mo. Next convention, November 17-19, 1914, Detroit, Mich.

MASTER BOILER MAKERS' ASSOCIATION.—Harry D. Vought, 95 Liberty St., New York.

MASTER CAR BUILDERS' ASSOCIATION.—J. W. Taylor, Karpen Bldg., Chicago.

MASTER CAR & LOCOMOTIVE PAINTERS' ASSOCIATION OF THE UNITED STATES AND CANADA.—A. P. Dane, B. & M., Reading, Mass. Next convention, September 8-11, Nashville, Tenn.

NATIONAL RAILWAY APPLIANCES ASSOCIATION.—Bruce V. Crandall, 537 So. Dearborn St., Chicago. Next convention, March 15 to 19, 1915, Chicago.

NEW ENGLAND RAILROAD CLUB.—W. E. Cade, Jr., 683 Atlantic Ave., Boston, Mass.; 2d Tuesday in month, except June, July, August and September, Boston.

NEW YORK RAILROAD CLUB.—H. D. Vought, 95 Liberty St., New York; 3d Friday in month, except June, July and August, New York.

NIAGARA FRONTIER CAR MEN'S ASSOCIATION.—E. Frakenberger, 623 Brisbane Bldg., Buffalo, N. Y. Meetings monthly.

PEORIA ASSOCIATION OF RAILROAD OFFICERS.—M. W. Rotchford, Union Station, Peoria, Ill.; 2d Thursday in month, Jefferson Hotel, Peoria.

RAILROAD CLUB OF KANSAS CITY.—C. Manlove, 1008 Walnut St., Kansas City, Mo.; 3d Friday in month, Kansas City.

RAILROAD MASTER TINNERS, COPPERSMITHS & PIPEFITTERS' ASSOCIATION.—U. G. Thompson, C. & E. I. Danville, Ill.

RAILWAY BUSINESS ASSOCIATION.—Frank W. Noxon, 30 Church St., New York.

RAILWAY CLUB OF PITTSBURGH.—J. B. Anderson, Penna. R. R., Pittsburgh, Pa.; 4th Friday in month, except June, July and August, Pittsburgh.

RAILWAY DEVELOPMENT ASSOCIATION.—W. Nicholson, Kansas City Southern, Kansas City, Mo.

RAILWAY ELECTRICAL SUPPLY MANUFACTURERS' ASSOCIATION.—J. Scribner, 1021 Monadnock Block, Chicago. Meetings with Association of Railway Electrical Engineers.

RAILWAY FIRE PROTECTION ASSOCIATION.—C. B. Edwards, Mobile & Ohio, Mobile, Ala. Annual meeting, October 6, Washington, D. C.

RAILWAY GARDENING ASSOCIATION.—J. S. Butterfield, Lee's Summit, Mo.

RAILWAY SIGNAL ASSOCIATION.—C. C. Rosenberg, Bethlehem, Pa. Annual meeting, Bluff Point, N. Y., September 22-24.

RAILWAY STOREKEEPERS' ASSOCIATION.—J. P. Murphy, Box C, Collinwood, Ohio.

RAILWAY SUPPLY MANUFACTURERS' ASSOCIATION.—J. D. Conway, 2136 Oliver Bldg., Pittsburgh, Pa. Meetings with M. C. B. and M. M. Associations.

RAILWAY TELEGRAPH & TELEPHONE APPLIANCE ASSOCIATION.—G. A. Nelson, 50 Church St., New York. Meetings with Association of Railway Telegraph Superintendents.

RICHMOND RAILROAD CLUB.—F. O. Robinson, C. & O., Richmond, Va.; 2d Monday in month, except June, July and August.

ROADMASTERS' AND MAINTENANCE OF WAY ASSOCIATION.—L. C. Ryan, C. & N. W., Sterling, Ill. Next convention, September 8-10, 1914, Chicago.

ST. LOUIS RAILWAY CLUB.—B. W. Frauenthal, Union Station, St. Louis, Mo.; 2d Friday in month, except June, July and August, St. Louis.

SALT LAKE CITY TRANSPORTATION CLUB.—R. E. Rowland, Hotel Utah Bldg., Salt Lake City, Utah; 1st Saturday of each month, Salt Lake City.

SIGNAL APPLIANCE ASSOCIATION.—F. W. Edmunds, 3868 Park Ave., New York. Meeting with annual convention Railway Signal Association.

SOCIETY OF RAILWAY FINANCIAL OFFICERS.—Carl Nyquist, La Salle St. Station, Chicago. Annual meeting, September 15-17, Hotel Aspinwall, Lenox, Mass.

SOUTHERN ASSOCIATION OF CAR SERVICE OFFICERS.—E. W. Sandwich, A. & W. P. Ry., Atlanta, Ga. Next meeting, July 16, Chattanooga, Tenn.

SOUTHERN & SOUTHWESTERN RAILWAY CLUB.—A. J. Merrill, Grant Bldg., Atlanta, Ga.; 3d Thursday, January, March, May, July, September, November, 10 A. M., Candler Bldg., Atlanta.

TOLEDO TRANSPORTATION CLUB.—J. S. Marks, Agent, Interstate Despatch, Toledo, Ohio; 1st Saturday in month, Boody House, Toledo.

TRACK SUPPLY ASSOCIATION.—W. C. Kidd, Ramapo Iron Works, Hillsburn, N. Y. Meetings with Roadmasters' and Maintenance of Way Association.

TRAFFIC CLUB OF CHICAGO.—W. H. Wharton, La Salle Hotel, Chicago.

TRAFFIC CLUB OF NEW YORK.—C. A. Swope, 291 Broadway, New York; last Tuesday in month, except June, July and August, Waldorf-Astoria, New York.

TRAFFIC CLUB OF PITTSBURGH.—D. L. Wells, Erie R. R., Pittsburgh, Pa.; meetings bimonthly, Pittsburgh. Annual meeting, 2d Monday in June.

TRAFFIC CLUB OF ST. LOUIS.—A. F. Versen, Mercantile Library Bldg., St. Louis, Mo. Annual meeting in November. Noonday meetings October to May.

TRAIN DESPATCHERS' ASSOCIATION OF AMERICA.—J. F. Mackie, 7122 Stewart Ave., Chicago.

TRANSPORTATION CLUB OF BUFFALO.—J. M. Sells, Buffalo; first Saturday after first Wednesday.

TRANSPORTATION CLUB OF DETROIT.—W. R. Hurley, Superintendent's office, L. S. & M. S., Detroit, Mich.; meetings monthly, Normandie Hotel, Detroit.

TRAVELING ENGINEERS' ASSOCIATION.—W. O. Thompson, N. Y. C. & H. R., East Buffalo, N. Y. Next meeting, September 15-18, Hotel Sherman, Chicago.

UTAH SOCIETY OF ENGINEERS.—Frank W. Moore, Newhouse Bldg., Salt Lake City, Utah; 3d Friday of each month, except July and August, Consolidated Music Hall, Salt Lake City.

WESTERN CANADA RAILWAY CLUB.—W. H. Rosevear, P. O. Box 1707, Winnipeg, Man.; 2d Monday, except June, July and August, Winnipeg.

WESTERN RAILWAY CLUB.—J. W. Taylor, 1112 Karpen Bldg., Chicago; 3d Tuesday of each month, except June, July and August, Karpen Bldg., Chicago.

WESTERN SOCIETY OF ENGINEERS.—J. H. Warder, 1735 Monadnock Block, Chicago; regular meeting 1st Monday in month, except January, July and August, Chicago. Extra meetings, except in July and August, generally on other Monday evenings.

Traffic News

The Salt Lake City Commercial Club Traffic Bureau has announced that it will change its name to the Traffic Bureau of Utah. This is to avoid misunderstanding because the bureau is not identified with the Commercial Club and members of the latter have objected to the action of the bureau in attacking the Union Pacific extra dividend.

F. R. Hanlon, district freight agent of the Oregon-Washington at Seattle, Wash., has been appointed director of traffic of the Port Commission of Seattle, a public body created by popular vote three years ago to take supervision over the waterfront rights, conduct inland water transportation lines and operate locomotive switching terminal service to and from the city's public wharves. The Port Commission property at present consists of two deep-sea docks and a steam ferry line operating within the corporate limits of Seattle between the mainland and the West Seattle peninsula, three miles. Terminal switching rates are now under discussion by the commission.

The Missouri Public Service Commission has issued an order prescribing rates for the transportation of merchandise by express, based on the plan put into effect by the Interstate Commerce Commission last February, and adopted since then by a number of state commissions. The companies are authorized to make the new rates effective on three days' notice, but not later than August 1. It is said that the new rates average 21 per cent. less than those hitherto in effect. The Missouri commission has been investigating express rates since January 1, but action in ordering the reduction was delayed by an injunction that still existed against the old railroad and warehouse commission. The injunction has been dissolved in the federal court.

Disagreement of the jury is the result of the trial of the suit of the government against the Pennsylvania Railroad, the Keystone Elevator and others, at Philadelphia, for alleged illegal rebates on shipments of grain to the Keystone Elevator. The suit has been on trial in the federal court at Philadelphia for four weeks. The jury was out 23 hours. A new trial will probably take place in September. The government charged that the railroad company favored the elevator by leasing buildings to it at an unreasonably low rate and by paying bills for alleged losses which were based on dishonest weights. A former employee of the elevator had been ordered to destroy certain records of weights, of which he saved some, and these fell into the hands of government inspectors.

A Brave Board of Trade

After three or four meetings between a special committee of the Brunswick board of trade and officers of the Atlanta, Birmingham & Atlantic, the commercial body has finally agreed to allow the road to discontinue two passenger trains between Brunswick and Thalman. Officers of the road showed with figures that these trains were being operated at a loss to the company. Although there was a general kick against permitting the road to discontinue them, the board finally arrived at such a decision.—*Macon Telegraph.*

American Shipbuilding in 1914

During the fiscal year ended June 30, 1914, there were built in the United States and officially numbered 1,291 vessels, of 311,578 gross tons, compared with 1,648 vessels, of 382,304 gross tons, for 1913, according to a report by the Bureau of Navigation. The principal vessels are four American-Hawaiian Company steamships, each of 6,600 gross tons, and three Grace Company steamships, each of 6,300 gross tons, all for the Panama canal trade and averaging 4,000 net tons. The steamship *Matsonia,* for Hawaiian trade, 9,728 gross tons, is the largest vessel built in the United States since 1905, and the *John D. Archbold,* 8,374 gross tons, is the largest oil tanker yet built in the United States. On the Great Lakes 10 steamers of over 1,000 tons each were built, the *Alton C. Dustin,* 7,978 gross tons, being the largest. Only three large schooners were built. In all, 38 vessels of over 1,000 tons each were built, aggregating 169,000 tons.

Car Surpluses and Shortages

Arthur Hale, chairman of the committee on relations between railroads of the American Railway Association, in presenting statistical bulletin No. 171, giving a summary of car surpluses and shortages by groups from March 1, 1913, to July 1, 1914, says: The total surplus on July 1, 1914, was 220,875 cars; on June 15, 1914, 232,994 cars, and on June 30, 1913, 70,740 cars. is a small increase of surplus box cars. In the spring wheat section (groups 6 and 7) there is practically no change in the figures. There is also a reduction in surplus box cars on the Pacific coast and in Canada.

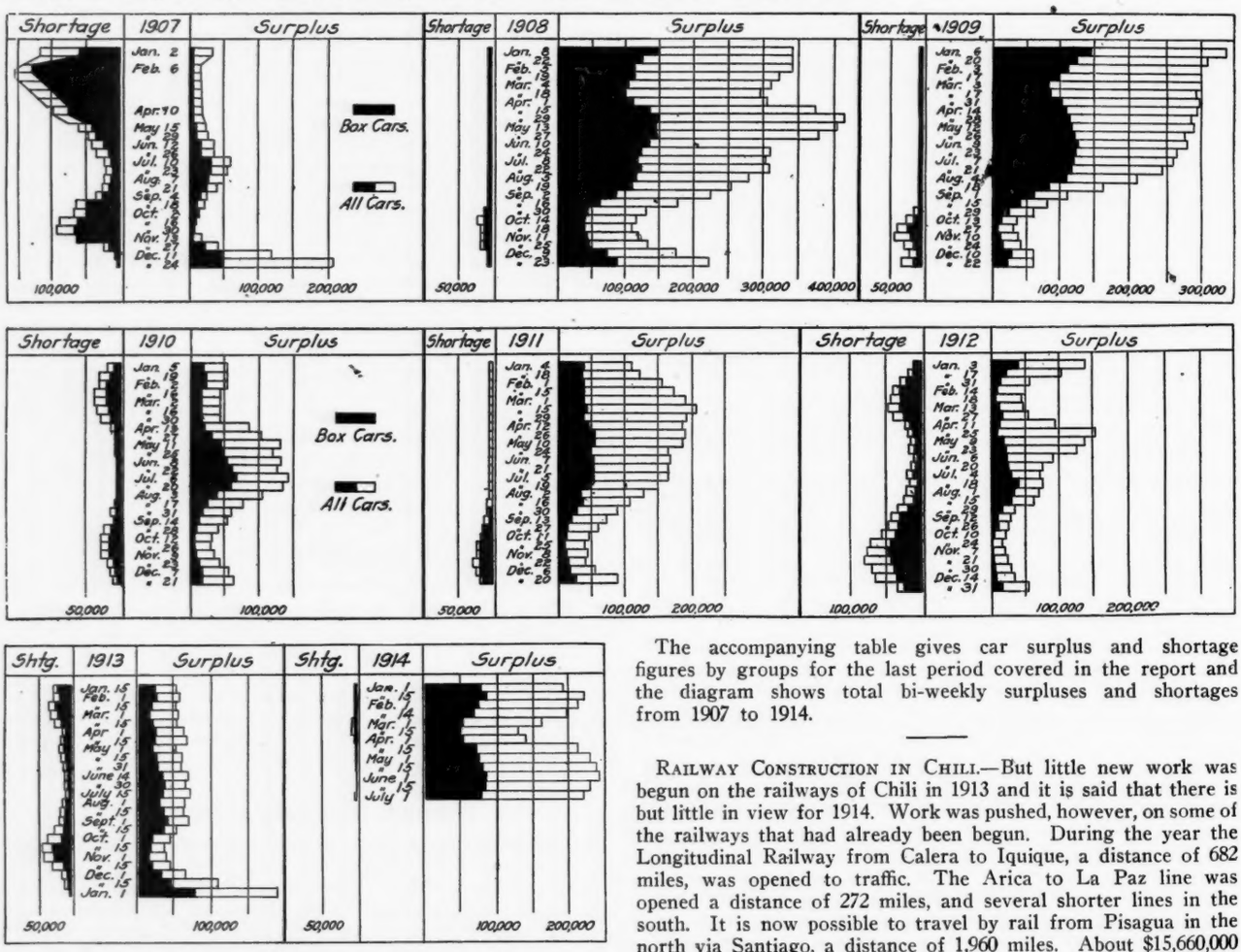
The total shortage on July 1, 1914, was 1,333 cars; on June 15, 1914, 660 cars, and on June 30, 1913, 7,036 cars.

No real shortage has yet developed.

CAR SURPLUSES AND SHORTAGES

Date	No. of roads.	Surpluses Box.	Flat.	Coal, gondola and hopper.	Other kinds.	Total.	Shortages Box.	Flat.	Coal, gondola and hopper.	Other kinds.	Total.
Group *1.—July 1, 1914	8	1,113	367	723	318	2,521	40	60	26	27	153
" 2.— " 1, 1914	32	3,382	189	18,769	8,412	30,752	32	0	0	1	33
" 3.— " 1, 1914	29	5,693	991	42,012	4,055	52,751	37	0	200	1	238
" 4.— " 1, 1914	12	6,752	1,096	7,447	1,341	16,636	0	17	0	0	17
" 5.— " 1, 1914	22	1,907	551	9,367	1,920	13,745	216	2	0	75	293
" 6.— " 1, 1914	28	15,868	647	7,055	6,108	29,678	154	22	9	10	195
" 7.— " 1, 1914	4	2,906	48	954	1,684	5,592	0	0	0	0	0
" 8.— " 1, 1914	15	12,797	563	2,147	4,277	19,784	152	38	154	16	360
" 9.— " 1, 1914	14	812	158	107	1,075	2,152	2	0	20	0	22
" 10.— " 1, 1914	21	14,843	1,354	2,699	9,694	28,590	1	0	21	0	22
" 11.— " 1, 1914	4	15,526	526	0	2,622	18,674	0	0	0	0	0
Total	189	81,599	6,490	91,280	41,506	220,875	634	139	430	130	1,333

*Group 1 is composed of New England lines; Group 2—New York, New Jersey, Delaware, Maryland and Eastern Pennsylvania lines; Group 3—Ohio, Indiana, Michigan and Western Pennsylvania lines; Group 4—West Virginia, Virginia, North and South Carolina lines; Group 5—Kentucky, Tennessee, Mississippi, Alabama, Georgia and Florida lines; Group 6—Iowa, Illinois, Wisconsin and Minnesota lines; Group 7—Montana, Wyoming, Nebraska, North Dakota and South Dakota lines; Group 8—Kansas, Colorado, Missouri, Arkansas and Oklahoma lines; Group 9—Texas, Louisiana and New Mexico lines; Group 10—Washington, Oregon, Idaho, California, Nevada and Arizona lines; Group 11—Canadian lines.



Car Surpluses and Shortages, 1907 to 1914

The surplus of 220,875 cars is the largest for the same period in any year since 1909.

There is generally a small reduction of coal car surplus in all groups except in central freight association territory where there is a small increase.

There is a reduction in box car surplus in New England, official classification territory, and in the western half of the southeast. In the winter wheat section (groups 8 and 9) there

The accompanying table gives car surplus and shortage figures by groups for the last period covered in the report and the diagram shows total bi-weekly surpluses and shortages from 1907 to 1914.

RAILWAY CONSTRUCTION IN CHILI.—But little new work was begun on the railways of Chili in 1913 and it is said that there is but little in view for 1914. Work was pushed, however, on some of the railways that had already been begun. During the year the Longitudinal Railway from Calera to Iquique, a distance of 682 miles, was opened to traffic. The Arica to La Paz line was opened a distance of 272 miles, and several shorter lines in the south. It is now possible to travel by rail from Pisagua in the north via Santiago, a distance of 1,960 miles. About $15,660,000 was expended on railway construction in Chili during the year, more than one-half being private capital guaranteed by the government. English capital controls 867 miles of Chilian railroads at a total investment of $120,096,468. A government commission has been appointed to thoroughly reorganize the operation of the state railways with the view of putting them on a paying basis. In connection with this it is proposed to place a loan for $24,332,500 to purchase rolling stock, to reorganize the repair shops and to complete double-tracking the line from Valparaiso to Santiago.

Commission and Court News

INTERSTATE COMMERCE COMMISSION

In Chicago, July 9, Chief Examiner Smith, of the Interstate Commerce Commission, resumed hearings which had been begun in New York in a general investigation, undertaken by the commission on its own motion, into private telegraph wire contracts, and a large number of grain brokers gave testimony; also representatives of the American Telephone & Telegraph Company, and the Western Union Telegraph Company.

Examiner Pugh, of the Interstate Commerce Commission, held a hearing at Portland, Ore., on July 1, on a complaint filed by the city of Astoria, Ore., asking for an adjustment of westbound rates which would put Astoria on the same basis as Puget Sound points. Representatives of the railways opposed this on the ground that it would cause a further reduction of the Portland rates, on the ground that Portland is 100 miles nearer the interior than Astoria, and that the result would be to reduce the Portland rates and the Puget Sound rates without improving the relative position of Astoria.

Pig Iron Rates from Virginia

Low Moor Iron Company of Virginia et al. v. Chesapeake & Ohio et al. Opinion by Commissioner Daniels:

The commission finds that the rates on pig iron from producing points in Virginia on the Chesapeake & Ohio and the Norfolk Western (Low Moor being taken as typical of points on the former and Roanoke of the latter) to points in New England and the Middle Atlantic states are unreasonable *per se* and discriminatory as compared to the rates on competing grades of pig iron from furnaces in Pennsylvania and New York. It is, therefore, ordered that the rates from these Virginia points to points of destination involved be not in excess of the following per gross ton: Baltimore, $2.25; Philadelphia, $2.75; New York, $3, and Boston $3.25. (30 I. C. C., 615.)

Coal Rates from Virginia Mines

Opinion by Commissioner McChord:

This case deals with the relationship between the rates on coal to points north of the Ohio from the St. Charles, or Black Mountain, and the Appalachia groups in southeastern Virginia, the mines at Benham, Ky., and the Middlesboro-Jellico group in southwestern Kentucky and northern Tennessee, all of which are served by the Louisville & Nashville. At present, all mines in the Middlesboro-Jellico district take the same rates to points north of the Ohio, but to points south the mines nearer the destinations take lower rates than those more distant. Rates from the St. Charles district to points south of the Ohio are 5 cents above the rates from La Follette, Tenn.; 10 cents above the rates from Middlesboro, Ky., and Jellico, Tenn., and 20 cents in excess of the rates from Links, Ky. To points north of the Ohio, the St. Charles district has the same rates as the Middlesboro-Jellico district. The rates from Appalachia and Benham to the destinations north of the Ohio are from 10 to 25 cents over the rates from St. Charles.

It is proposed, however, to establish rates from the St. Charles mines to a large number of destinations north of the Ohio, which will be from one to 30 cents higher than from the Middlesboro-Jellico group. Changes are also proposed in the Appalachia and Benham rates, but in general the rates from the Appalachia district will bear the same relation to the rates from St. Charles as at present. The proposed Benham rates are in nearly all cases below the Appalachia rates and in some cases below the rates from St. Charles, but in all cases they are higher than the Middlesboro-Jellico rates. Practically all of the changes are in the form of reductions.

The commission finds that there is justification for higher rates from St. Charles than from the Middlesboro-Jellico district in that the cost of handling is greater. It holds, however, that the differential should not correspond to the entire additional operating cost for the distance from St. Charles to Middlesboro, but that it should, instead, bear a fair relation to the out-of-pocket cost which the St. Charles traffic occasions to the carriers between Pennington and Middlesboro. This cost, as defined in *Louisville & Nashville Coal and Coke Rates,* includes the additional cost of fuel and train supplies, the extra wages of the crews and the repairs to locomotives and cars, amounting in all to 10 cents a ton.

It is therefore held that the rates from mines in the St. Charles group to points north of the Ohio within 400 miles from St. Charles should not exceed the rates from the Middlesboro-Jellico group to said destinations by more than 10 cents per ton and that beyond that the differential should decrease not less than one cent for each additional 100 miles. The rates from mines in the Appalachia group and the mines at Benham are not to exceed the rates from the Middlesboro-Jellico group to points north of the Ohio by greater amounts than the present differentials, but in no case are the differentials of Appalachia over the Middlesboro-Jellico district to be less than the differentials of St. Charles over the same district. These differentials are to be regarded as maxima and the carriers may establish smaller ones should conditions so require. (30 I. C. C., 636.)

Fourth Section Applications

In re rates on tropical fruits from Gulf ports to various destinations. Opinion by the commission:

This case relates to two applications covering rates on tropical fruits, viz., bananas, oranges, pineapples and cocoanuts from the Gulf ports to practically all points in the United States which do not conform with the long and short haul clause. Application No. 659 covers rates from Galveston, Port Bolivar, Port Arthur, Texas City, Houston and Orange, Tex. Galveston is taken as representative. Application 2,176 relates to rates from New Orleans and Port Chalmette, La.; Mobile, Ala., and Pensacola, Fla., but the case considers only the rates from New Orleans to points west of the Mississippi and in general the relief asked is by roads who wish to meet the competition of more direct competitors. The principal departures in the rates from Galveston are those in the rates to points on the Missouri river, Kansas City, Mo., and north thereof, comprising what are generally known as Missouri river points, stations basing thereon, and points east thereof. The rates to these stations, via all lines, are lower than to intermediate points. There is no movement from Galveston except on bananas and cocoanuts, so the carriers have agreed to revise their rates on other fruits to conform with the fourth section. The rate on bananas via all routes from Galveston to Kansas City, Mo., is 58 cents, and this rate is exceeded at intermediate points on all lines. The lines reaching Kansas City through Oklahoma carry higher rates, with few exceptions, to all points north of the Texas-Oklahoma line, the rates to such points varying from 62 to 70 cents per 100 lb. On the Kansas City Southern, the rates from Galveston are highest to points in northern Oklahoma and southern Kansas (62 to 70 cents) and begin to grade down just before reaching Kansas City, reaching their lowest level at points on and in the vicinity of the Mississippi (St. Louis, 43 cents) in Illinois and in western and southern Indiana and then grading upward again as the distance from Galveston increases. These rates bear a definite relationship to the rates from New Orleans and were so adjusted in order to place Galveston on a parity with New Orleans. Despite this aid, however, Galveston still bears a minor position in this business as compared with New Orleans.

To most of the territory east of the Missouri river to which petitioners carry lower rates than to intermediate points the distance via their routes from Galveston is greater than the distance via the lines from New Orleans, and while to some of the territory immediately east of the east bank of the Missouri river the distance from Galveston is less than from New Orleans, the commission holds that on the whole these carriers should be permitted to continue to carry rates to all points east of the east bank of the Missouri river the same as or made with relation to the rates from New Orleans and to continue higher rates to intermediate points.

It does not appear that the direct lines from Galveston to points on and west of the Missouri are at any disadvantage in meeting the competition of the New Orleans lines on account of having circuitous routes. Accordingly, the part of the application for relief from the fourth section relating to these rates is denied.

It is held that the Galveston lines are entitled to some relief in respect to rates to points east of the Mississippi which have been reduced to meet the competition from New Orleans. The present disparities between rates to intermediate points and those to more distant points are, however, termed too great.

The short line carrier between Galveston and Kansas City and other Missouri river points and points east thereof is refused permission to maintain rates to these points lower than to intermediate points, but carriers whose mileage exceeds that of the short line by not less than 15 per cent. may meet the rates of the short line and carry higher rates to intermediate points not less than 800 miles from Galveston. It is made a condition, however, that rates to intermediate points 800 miles and less from Galveston shall not exceed 62 cents per 100 lb. and to intermediate points of greater distances than 800 miles from Galveston shall not exceed the rate of 62 cents by more than one and one-half cents per 100 lb. for each additional 25 miles or fraction thereof.

With regard to rates via the circuitous lines from New Orleans relief is granted wherever the long line is not less than 15 per cent. longer than the short line.

The same measure of relief is granted in respect to rates on cocoanuts as on bananas, but where 62 cents per 100 lb. is prescribed as the maximum rate that may be charged on bananas from Galveston to points on indirect lines intermediate to Kansas City not more than 800 miles from Galveston, the rate on cocoanuts shall not exceed 45 cents and the amounts added to this rate to points of greater distance shall not be greater than the amounts added for the transportation of bananas as provided herein, namely, one and one-half cents per 100 lb. for each additional 25 miles or fraction thereof. (30 I. C. C., 621.)

STATE COMMISSIONS

Complaints involving joint rates and through routes between Missouri points have been set for hearing before the Missouri Public Service Commission at Jefferson City, Mo., on July 21. Every railroad in the state has been notified to be present.

The Texas Railroad Commission has issued a statement declining to approve or disapprove of the tariff submitted by the Texas railways, increasing the freight rates from Houston and Dallas to points in East Texas, in accordance with the order of the Interstate Commerce Commission recently sustained by the Supreme Court in the Shreveport case. The commission states that there is no valid reason for action on its part, and that there is no purpose of holding the railroads in fear of suits for penalties, as obedience to a judgment of the Supreme Court of the United States cannot be prosecuted as a wilfull violation of the laws of Texas.

COURT NEWS

In the federal court at Danville, Ill., July 6, the Vandalia Railroad was fined $2,000 for the payment of illegal rebates.

The Supreme Court of Missouri on July 2 issued an order directing the Missouri Public Service Commission to undertake an investigation to determine whether the two-cents-a-mile passenger fare required by the Missouri law is confiscatory as to the Missouri Southern Railroad. That road applied to the commission some time ago for an order permitting it to charge three cents a mile, and the commission held that it was limited by the law to two cents. The railroad then applied to the Supreme Court for a mandamus compelling the commission to make the investigation, and the court issued the order requested.

In the United States District Court at Rochester, N. Y., July 13, indictments were filed against the Pennsylvania Railroad, the Northern Central, the Delaware, Lackawanna & Western and the Delaware, Lackawanna & Western Coal Company for alleged illegal acts in connection with the transportation of coal. Charges of violation of the commodities clause of the Interstate Commerce Law constitute the basis for the indictments against the Pennsylvania, the government alleging that the railroad company is the real owner of certain coal mining corporations and, therefore, the real owner of coal shipped. The Lackawanna is charged with discrimination against outside coal dealers by renting terminal properties at Buffalo at nominal rates.

Railway Officers

Executive, Financial, Legal and Accounting

Frank A. Peil has been appointed assistant to the president of the Oregon-Washington Railroad & Navigation Company, with office at Portland, Ore.

C. H. Carpenter has been appointed freight claim agent of the Alabama, Tennessee & Northern, with office at York, Ala., succeeding Clayton Jones, resigned to go into other business.

President E. Dickinson, of the Kansas City, Mexico & Orient, announces that the positions of general manager and buyer are abolished and the duties of those offices will be assumed by the president. Lawrence V. Guild has been appointed assistant to the president, with headquarters at Kansas City, Mo., effective July 7.

J. P. Pelham has been appointed assistant auditor of the Piedmont & Northern. E. B. Hardin has been appointed traveling auditor, and W. T. Gill has been appointed freight claim agent, with headquarters at Charlotte, N. C. Reports and correspondence relative to station accounts, interline freight and ticket accounts and car service and per diem reports are sent to the assistant auditor.

Operating

T. L. Terrant has been appointed terminal trainmaster of the Baltimore & Ohio in charge of the Lorain, Ohio, terminals.

J. W. Carnes, trainmaster of the Trinity & Brazos Valley, has been appointed assistant general superintendent, with headquarters at Teague, Tex.

H. B. Grimshaw, superintendent of the Alabama division of the Seaboard Air Line at Americus, Ga., has been appointed general manager of the Macon, Dublin & Savannah, with office at Macon, Ga.

P. T. Carmody, assistant trainmaster of the Lehigh Valley at Cortland, N. Y., has been appointed trainmaster, with office at Cortland, and G. R. Lewis, assistant trainmaster at Auburn, has been appointed trainmaster, with office at Auburn.

Rutledge Smith, general agent for the receivers of the Tennessee Central at Nashville, Tenn., has been appointed also superintendent, and D. F. Bunch, trainmaster at Nashville, has resigned on account of illness and his former position has been abolished.

T. W. McGaw, superintendent of the Savannah Terminal division of the Seaboard Air Line, has been appointed superintendent of the Alabama division, with headquarters at Savannah, Ga., succeeding H. B. Grimshaw, resigned to go to another company, and the Savannah Terminal division has been consolidated with and is now a part of the Alabama division.

I. L. Boomer, superintendent of the Canadian Northern at Edmonton, Alta., has been appointed superintendent of the newly created Fourth district Western division, with headquarters at Calgary. J. C. O'Donnell, trainmaster at Rainy River, Ont., has been appointed superintendent, with office at Edmonton, succeeding Mr. Boomer. M. G. Hurd, chief despatcher at Saskatoon, Sask., has been appointed chief despatcher and trainmaster, with office at Calgary, Alta., and R. Nelson, chief despatcher at Edmonton, has been appointed chief despatcher and trainmaster, with office at Edmonton.

Ross S. Marshall, whose appointment as superintendent of the Virginia division of the Seaboard Air Line, with headquarters at Richmond, Va., has already been announced in these columns, was born on March 15, 1880, at Rock Island, Ill., and was educated in the high school at Anaconda, Mont. He began railway work in 1896 on the Great Northern, and was chief clerk in the superintendent's office when he left that company in October, 1902, to go to the Chicago, Rock Island & Pacific as division accountant and chief clerk to the division engineer. From September, 1905, to September, 1907, he was chief clerk to the general manager and local auditor of the Panama Railroad at Colon, Panama, and then entered the service of the

New York, New Haven & Hartford as statistician in the general superintendent's office. He remained in this position until November, 1910, and then was appointed assistant to vice-presdent of the Minneapolis & St. Louis. In September, 1912, he was appointed superintendent at Oskaloosa, Iowa, of the same road, which position he held at the time of his recent appointment as superintendent of the Seaboard Air Line, with office at Richmond, Va., as above noted.

Traffic

F. R. Johnson has resigned as general agent of the passenger department of the Canadian Pacific at Portland, Ore.

I. G. Thompson has resigned as commercial agent of the Rock Island Lines at Ft. Worth, Tex., to engage in other business.

R. W. Foster, commercial agent of the Chicago, Burlington & Quincy at Portland, Ore., has been appointed general agent at that place, succeeding A. C. Sheldon, deceased.

J. F. Dalton has been appointed assistant general freight agent of the Norfolk Southern, with office at Norfolk, Va., and Boyd Suthers has been appointed commercial agent, with office at Pittsburgh, Pa.

Dan C. Pettibone, general agent of mail traffic of the Northern Pacific, has been appointed general baggage agent, with headquarters at St. Paul, Minn. The mail and baggage departments have been combined in one department under Mr. Pettibone.

E. S. Center, general agent of the Atlanta & West Point and the Western Railway of Alabama at Atlanta, Ga., has been appointed assistant general freight agent of both roads, with office at Atlanta, and F. G. Browder, Jr., assistant general freight agent at Montgomery, Ala., has been transferred in the same capacity to Atlanta, Ga.

W. T. Stevenson, whose appointment as assistant general freight agent of the Cleveland, Cincinnati, Chicago & St. Louis, with headquarters at Cincinnati, Ohio, has already been announced in these columns, graduated from the Covington (Ky.) high school in 1890, and began railway work the same year as messenger in the office of the Chesapeake & Ohio at Cincinnati. Subsequently he was successively clerk, stenographer, ticket agent, traveling freight agent and chief clerk, until February, 1902, when he was appointed division freight agent of the Cincinnati Northern at Jackson, Mich. In November, 1907, he was promoted to chief of the tariff bureau of the Cleveland, Cincinnati, Chicago & St. Louis, which position he held at the time of his recent appointment as assistant general freight agent, as above noted.

William O. Sydnor, whose appointment as assistant general freight agent of the Chesapeake & Ohio, with headquarters at Charleston, W. Va., has been announced in these columns, was born on December 18, 1858, in Dinwiddie county, Va., and was educated in the common schools. He began railway work on January 1, 1876, as assistant agent at Burkeville, Va., on the Atlantic, Mississippi & Ohio, now a part of the Norfolk & Western. From 1880 to 1888, he was agent of the Chesapeake & Ohio at Millboro, Va.; in 1889 he was appointed agent and yardmaster at Staunton, Va., and from 1896 to 1900 was purchasing agent of the same road. He was promoted in 1901 to division freight agent at Staunton, and in 1908 was transferred in the same capacity to Charleston, W. Va., which position he held at the time of his recent appointment as assistant general freight agent of the same road, as above noted.

Engineering and Rolling Stock

W. C. Barrett has been appointed division engineer of the Lehigh Valley, with office at Sayre, Pa.

A. G. Kinyon has been appointed superintendent of locomotive operation of the Seaboard Air Line, with headquarters at Portsmouth shops, Portsmouth, Va.

J. W. Williams, assistant chief engineer of the Northwestern Pacific, has been appointed chief engineer construction, succeeding William C. Edes, resigned, and F. K. Zook, engineer maintenance of way, has been appointed chief engineer maintenance and structural engineer, both with headquarters at San Francisco, Cal. William S. Wollner, engineer in charge of the chief engineer's office, has had his jurisdiction extended over the maintenance of way department.

Mr. Williams, who will be the senior engineer on all construction work, was born in 1879 at Milan, Ohio. He graduated from high school in 1897 and began railway work in 1900 as chainman on location survey on the Albuquerque Eastern. Later in the year he worked with the city engineer of Albuquerque and afterwards was employed in the mechanical department of the Atchison, Topeka & Santa Fe at that place. During 1901 and 1902 he was with the Santa Fe Central as chainman, levelman and transitman on location and construction; in the spring of 1903 he was employed as transitman on location surveys for the Eastern Railway of New Mexico, and in July of that year he was transferred to the San Francisco & Northwestern in California, where he was employed on location surveys along the Russian river and the South Fork of the Eel river. In 1904 and 1905 he was assistant engineer on construction of the Oakdale Western and the Ft. Bragg & Southeastern, and in 1906 served in the same capacity on the San Francisco & Northwestern making various surveys and investigations. Mr. Williams was made acting chief engineer of the latter road in August, 1906, and when the Northwestern Pacific was formed in 1907 by the consolidation of several northern California lines, he was appointed assistant chief engineer of that road, which position he held at the time of his recent appointment as chief engineer construction, as above noted.

J. W. Williams

E. C. Sasser, whose appointment as superintendent of motive power of the Northern and Eastern districts of the Southern Railway, with headquarters at Washington, D. C., has been announced in these columns, was born on November 16, 1875, in Wake county, N. C., and was educated at Holden Academy, Raleigh. He began railway work at the age of 16 in the shops of the Raleigh & Gaston, now a part of the Seaboard Air Line, as machinist's apprentice at Raleigh, and at the completion of his apprenticeship entered the service of the Southern Railway at Alexandria, Va., and was then consecutively machinist, machine shop foreman and general foreman. In 1898 he returned to Raleigh and entered the service of the Lobdell Car Wheel Manufacturing Company. The following year he went to the Seaboard Air Line at Raleigh, leaving that company in May, 1901, to become superintendent of the Acme Machine Works, Goldsboro, N. C. He went to the Southern Railway in May, 1902, as erecting shop foreman at Columbia, S. C., and was promoted to general foreman in August of the same year. The following October he left that company to enter the service of the American Locomotive Company at the Richmond branch as equipment inspector. The following year he was promoted to general

E. C. Sasser

machine shop foreman and in March, 1905, left that company to return to the service of the Southern Railway as shop superintendent. He was promoted to master mechanic of the Charleston shops in May, 1908, and in October of the following year was transferred in the same capacity to the Alexandria shops. He was again transferred in May, 1910, as master mechanic of the Spencer, N. C., shops, which position he held at the time of his recent appointment as superintendent of motive power of the same road, as above noted.

D. Hickey, master mechanic of the Southern Pacific at Sparks, Nev., has been transferred to Ogden, Utah, in a similar capacity. T. D. LaMasters has been appointed general car foreman at Ogden.

Purchasing

The office of C. D. Baldwin, purchasing agent of the Bangor & Aroostook at Milo Junction, Me., has been removed to Derby.

T. D. Singletary has been appointed storekeeper of the Macon, Dublin & Savannah, with office at Macon, Ga., succeeding G. S. Pratt, resigned.

Special

The authority of H. R. Buckey, agent of the land and industrial department of the Southern Railway at Bristol, Tenn., has been extended over the Georgia Southern & Florida, the Hawkinsville & Florida Southern and the Macon & Birmingham, with headquarters at Macon, Ga., succeeding C. W. Fitch, resigned to accept services with another department, and F. L. Merritt has been appointed agent, with headquarters at Bristol, Tenn., succeeding Mr. Buckey.

OBITUARY

Robert M. Boyd, general agent of the freight department of the Chicago, Milwaukee & St. Paul at Seattle, Wash., died in the latter city on July 6.

Henry R. Emmerson, formerly from 1904 to 1907, minister of railways and canals for Canada, and previous to that premier of New Brunswick, also a member of the Dominion Parliament, died on July 9, at Dorchester, New Brunswick.

Samuel F. Prince, Jr., formerly superintendent of motive power and rolling equipment of the Philadelphia & Reading, died in New York City on July 13, from the effects of a bullet wound. Mr. Prince was born 62 years ago and previous to January, 1892, was mechanical engineer of the Philadelphia & Reading, and then to the following March was assistant consulting engineer of the Long Island. He was appointed superintendent of motive power in March, 1892, and from February, 1893, to August, 1899, was superintendent of motive power and equipment of the same road. On August 1, 1899, he was appointed superintendent of motive power and rolling equipment of the Philadelphia & Reading and left that company in June, 1904, to enter the service of the Niles-Bement-Pond Company, at New York. He retired some years ago from active service on account of ill health.

ELECTRIC LOCOMOTIVES IN ENGLAND.—Announcement has recently been made to the effect that the Northeastern Railway in England will conduct some exhaustive experiments with electric engines on its line between Middlesborough, Yorkshire, and Bishop Auckland, Durham, which is used for "mineral" traffic. The engines are reported to be of German design and are now being put together at Darlington. They will be able to draw 100 coal or coke cars each containing 20 tons.

AUTOMATIC BRAKES FOR RUSSIAN RAILWAYS.—A committee has recently been formed in St. Petersburg to consider the question of fitting all freight cars with automatic brakes. Should the decision be favorable, the work will be spread over a period of six years.

SIGNAL STATISTICS OF THE GREAT WESTERN RAILWAY OF ENGLAND.—On the 3,007 miles of Great Western Railway of England, there are 1,611 signal towers, 43,456 working levers, 6,784 spare spaces, 20,430 signals, 3,191 interlocked switches and 682 crossing gates.

Equipment and Supplies

LOCOMOTIVE BUILDING

THE TOLEDO TERMINAL RAILROAD is inquiring for 5 locomotives.

THE CANADIAN PACIFIC has ordered 10 locomotives from the Montreal Locomotive Works.

W. R. GRACE & COMPANY, New York, are in the market for 2 tank engines (2-8-4 type) for use in Peru.

THE PITTSBURG & SHAWMUT has ordered 6 Mikado type locomotives from the Baldwin Locomotive Works.

THE INTERNATIONAL RAILWAYS OF CENTRAL AMERICA have ordered 5 locomotives from the Baldwin Locomotive Company.

THE FOSBURGH LUMBER COMPANY, Norfolk, Va., has ordered one Prairie type locomotive from the Baldwin Locomotive Works.

THE GRAND RAPIDS & NORTHWESTERN is in the market for 3 Mikado type, 5 ten-wheel and a number of six-wheel switching locomotives.

THE GREEN BAY & WESTERN has ordered one superheater Mogul type locomotive from the American Locomotive Company. This locomotive will have 19 by 26 in. cylinders, 56 in. driving wheels, a total weight in working order of 141,000 lb. and a steam pressure of 180 lb.

CAR BUILDING

THE BUFFALO, ROCHESTER & PITTSBURGH is in the market for 10 caboose cars.

THE TAMPA & GULF COAST is inquiring for a number of passenger train cars.

THE CHICAGO, INDIANAPOLIS & LOUISVILLE is in the market for 250 to 260 40-ton box cars.

THE CANADIAN NORTHERN has ordered 8 passenger cars from the Pressed Steel Car Company.

THE DELAWARE, LACKAWANNA & WESTERN has ordered 200 mine cars from the Magor Car Company.

THE PITTSBURG & SHAWMUT has ordered 25 refrigerator cars from the American Car & Foundry Company.

THE CHICAGO & ILLINOIS MIDLAND has ordered 250 gondola cars from the American Car & Foundry Company.

THE PENNSYLVANIA RAILROAD has instructed its Altoona shops to proceed with the construction of 1,000 all-steel box cars.

THE PHILADELPHIA & READING is reported to have ordered 6 baggage cars from its shops at Reading. This item has not been confirmed.

THE SOUTHERN PACIFIC is in the market for 2,600 50-ton double sheath box, 400 50-ton flat, 850 40-ton single deck stock, 250 50-ton gondola, 300 12,500 gal. cap., 50-ton tank, and 20 caboose cars and 150 50-ton flat car bodies. The same company has also asked prices on 40 60-ft. passenger coaches.

IRON AND STEEL

THE SOUTHERN RAILWAY has ordered 15,000 tons of rails from the Tennessee Coal & Iron Company.

THE CHICAGO, ROCK ISLAND & PACIFIC has ordered 17,000 tons of rail from the Colorado Fuel & Iron Company.

THE PENNSYLVANIA RAILROAD has placed orders for 100,000 tons of steel rails with the following companies: United States Steel Corporation, 44,000 tons; Pennsylvania Steel Company, 22,000 tons; Cambria Steel Company, 22,000 tons; Bethlehem Steel Company, 6,000 tons, and the Lackawanna Steel Company, 6,000 tons. All of these orders are to be of 100 lb. section, with the exception of 5,000 tons of the Pennsylvania Steel Company order, which will be of 120 lb. section.

Supply Trade News

Stephen C. Mason, secretary of the McConway & Torley Company, Pittsburgh, Pa., has accepted appointment as an executive member of the Railway Business Association. William McConway, president of the same company, recently retired as an executive member of the association.

H. A. Strauss, consulting engineer, Chicago, has been retained by the bondholders' committee of the Alton, Jacksonville & Peoria Railway, to prepare a complete valuation of the company's property to be submitted to the Illinois Public Utilities Commission in connection with the application for authorization of a reorganization of this company and the issuance of stocks and bonds.

The Railroad Valuation Company has recently been organized, with offices at 25 Broad street, New York, with a staff of engineers, analysts and accountants of wide experience in valuation work for the purpose of preparing maps and other data for railroads who have to submit such data in the federal valuation and may not otherwise have the advantage of a special staff for this work.

Ralph W. Perry, chemist and engineer of tests for the Michigan Central during the construction of the Detroit river tunnel and the improved terminal facilities at Detroit, has severed his connection with the company and has leased its laboratory at Fifth street and River Front, Detroit, renaming it the Perry Testing Laboratory, with the idea of conducting a general chemical, inspecting and testing business.

Mudge & Co., Chicago, are now manufacturing and selling their own passenger car ventilator which is known by the trade name "Mudge-Peerless." Attractive folders illustrating and describing this device are now ready for mailing to those interested. This company is now representing in western territory the Chambers Valve Company of New York. The Chambers throttle valve now being exclusively manufactured by the latter company was recently acquired from the Watson Stillman Company.

On application made in the United States District Court at Buffalo, for the appointment of receivers for the United States Light & Heating Company, Buffalo, N. Y., on the charge of fraud, Judge Hogel has named Guy Walker, a member of the stockholders' investigating committee; James O. Moore, a Buffalo attorney, and H. Henry Ackerman, the present vice-president and general manager of the company. The receivers are under a joint bond of $100,000 and have been instructed to continue the business. The charges on which the application for receivers was based resulted from the findings of the investigating committee, composed of Guy M. Walker, F. R. Humpage and John A. Sleicher. It is alleged that illegal stock issues were made, consisting of $100,000 to William Hawley, of New York; $10,000 to Sanford Adler, and $100,000 to J. Allen Smith. The latter is the president of the company and Mr. Hawley is a director. The action was precipitated by the issuing by the company of a circular to stockholders offering them $1,500,000 6 per cent. bonds for subscription by July 15. This bond issue was authorized at a special meeting of the stockholders, on the suggestion of the stockholders' investigating committee. The bond offering was made to stockholders without the signatures of the members of the investigating committee.

TRADE PUBLICATIONS

COAL PICKS.—The National Malleable Castings Company, Cleveland, O., has recently issued circular No. 67, descriptive of the company's malleable iron coal picks for locomotive tenders.

ELECTRIC METERS.—The Esterline Company, Indianapolis, Ind. has issued catalog No. 321, descriptive of Esterline model E-B graphic efficiency meters. The booklet contains a detailed description of the instruments and views are included showing the various types of meters and their parts.

Railway Construction

AKRON, CANTON & YOUNGSTOWN.—An officer writes regarding the report that the company is carrying out the plans made some time ago to build an extension from Mogadore, Ohio, east to Youngstown, about 40 miles; also that an extension is to be built from Akron north to Cleveland; that it has not yet been definitely decided to extend the line. The company now operates a 10-mile freight line between Akron, Ohio, and Mogadore.

BUTLER COUNTY,—This road has been extended from Styra, Ark., to Piggott, eight miles. (August 22, p. 353.)

CHICAGO, BURLINGTON & QUINCY.—The improvements now under way in the yards, outside of St. Paul, Minn., include the filling of 14 acres of marsh land, the extension of the present tracks to a length of 4,500 ft., the construction of 5 new tracks, a coach ward and 2 new switching leads. There will also be erected a 12-stall roundhouse, a large transfer platform and a steel water tank with a capacity of 100,000 gallons. This repair yard will have a capacity of 200 cars daily. The cost of improvements is estimated at $250,000.

FORT WORTH-DENTON INTERURBAN.—A meeting of the stockholders will be held July 24, it is said, to formally transfer the right of way and other holdings to the Stone & Webster Syndicate, of Boston, Mass., which will build and operate the line from Fort Worth, Tex., north to Denton, 32 miles. As soon as the transfer has been made construction work is to be started. (December 26, p. 1249.)

GREAT NORTHERN.—An officer writes that a contract has been given to Guthrie, McDougall & Company for work on a change of line on 1.3 miles at Paola, Mont. The work is now under way and includes one double-track tunnel 900 ft. long. The estimated cost of the work is about $250,000.

MINKLER SOUTHERN.—This new single-track line, extending from Minkler through Cutler to Exeter, Cal., a distance of about 40 miles, has just been completed by the Atchison, Topeka & Santa Fe. Operation will begin August 1.

MOULTRIE SOUTHWESTERN.—Application has been made in Georgia for a charter to build from Moultrie southwest through the counties of Colquitt, Mitchell, Grady and Decatur to the Florida state line. The right of way has been secured and work is now under way; about four miles have been completed. W. E. Aycock, Moultrie, is interested.

NEWAUKIM RAILROAD.—An officer writes that the plans call for building from Napavine, in the state of Washington, east via Onaloska. Work is now under way by the company's forces on the first 11 miles to Onaloska. There will be a 300-ft. trestle on this section. The company expects to develop a traffic in logs, farm products, merchandise and live stock. William Carlisle, president, Atchison, Kan.; O. O. Ort, engineer, Centralia, Wash.

NORTHERN PACIFIC.—The Mandon north line of the Dakota division has been extended from Stanton, N. D., west to Golden Valley, 34 miles. (May 1, p. 1011).

OKLAHOMA, NEW MEXICO & PACIFIC.—This road has been extended from Wilson, Okla., west to Ringling, 10 miles. (April 17, p. 927.)

OLYMPIA TERMINAL.—See Oregon-Washington Railroad & Navigation Company.

OREGON-WASHINGTON RAILROAD & NAVIGATION COMPANY.—An officer writes that a contract has been given to the Twohy Brothers Company, Portland, Ore., to build under the name of the Olympia Terminal a new line near Olympia, Wash. The maximum grade will be 1 per cent. compensated, and maximum curvature 15 degrees. There will be a pile trestle 795 ft. long and another 570 ft. long. The plans include putting up a station and freight house at Olympia.

REGISTER & GLENNVILLE.—This company, which operates a 39-mile line from Glennville, Ga., north to Register, is making surveys, it is said, for an extension northeast to Statesboro about 10 miles.

SHEFFIELD & TIONESTA.—This road is now in operation from Sheffield, Pa., southwest to Tionesta, 41 miles.

SUTHERLIN, COOS BAY & EASTERN.—Surveys are now being made, it is said, and contracts for building the line may be let in the near future. The plans call for a line from Sutherlin, Ore., east about 27 miles to the head of Calapooia river. H. D. Haley, Sutherlin, is engineer in charge, and C. M. Crego, Spokane, Wash., is interested. (June 19, p. 1565.)

RAILWAY STRUCTURES

BUFFALO, N. Y.—Contracts are to be let at once for building the new passenger terminal for the Lehigh Valley on Main street, in Buffalo. It will be of Colonial design and is to be built of Indiana limestone. Preparatory work for carrying out this improvement was begun some time ago and actual work on the new terminal must be started by August 1. (September 26, p. 586.)

CLINTON, IOWA.—The contract for the construction of the Chicago & North Western repair yard at Clinton, Iowa, noted in the *Railway Age Gazette* of last week, has been awarded to the Walsh Construction Company, Davenport, Iowa.

GALVESTON, TEX.—The new eight-story office and depot building of the Gulf, Colorado & Santa Fe has just been completed and the offices are being moved from the old building into the new. The building has a frontage of 100 ft. and a depth of 125 ft. It is a fireproof structure of vitreous buff brick and concrete.

NORTH WILKESBORO, N. C.—The Southern Railway has given a contract to Porter & Boyd, Charlotte, N. C., for building a new brick, with tin shingle roof, combined freight and passenger station and covered platform at North Wilkesboro, to replace the old combined station recently destroyed by fire. The improvements will include a platform, 36 ft. by 240 ft. The station will have separate waiting rooms for white and colored passengers, also a freight and baggage room, express room and freight and ticket offices.

PHILADELPHIA, PA.—Mayor Blankenburg has signed an ordinance under which the city and the Philadelphia & Reading Railway Company will co-operate to do away with a number of grade crossings in Port Richmond. The agreement embodied in the ordinance as to apportionment of cost between the city and the railway has been under discussion for more than a year. The tracks will be elevated to permit the opening of Emerald and Tulip streets between Lehigh avenue and Somerset street. The lines and grades of Aramingo avenue will be revised to conform with the plans. Pike street, from Third to Lawrence, will be abandoned. Construction of additional tracks is also authorized by the ordinance.

REIDSVILLE, N. C.—The Southern Railway has given a contract to J. P. Pettyjohn & Company, Lynchburg, Va., for building a new brick, tile roof passenger station at Reidsville. The building will be 22 ft. by 100 ft. and will include separate waiting rooms for white and colored passengers, also a baggage room and ticket office. The building will be equipped with steam heat and electric light. A contract for the construction of the heating system has been let to the General Fire Extinguisher Company, Charlotte, N. C.

ST. PAUL, MINN.—A roundhouse and locomotive plant, consisting of a 33-stall roundhouse, a machine shop with 7 repair pits, a tank and paint shop with 5 repair pits, a turntable, coal docks and a three-story brick storehouse for the use of the mechanical department, will be erected near the Union depot at St. Paul by the Northern Pacific. This new plant will be used chiefly for the care of passenger and switching power. The estimated cost is about $500,000.

SOUTH BOSTON, VA.—The Southern Railway has given a contract to the Wise Granite & Construction Company, Richmond, Va., for building a new brick passenger station at South Boston with tile roof. The new building will be 25 ft. by 106 ft. and will include separate waiting rooms for white and colored passengers, a baggage and express room and ticket office.

TACOMA, WASH.—Bids for a new $100,000 freight shed for the Oregon-Washington Railroad & Navigation Company in Tacoma were to be received on Wednesday. This shed is to be built on the tideflats at Fifteenth street and the city waterway. G. W. Boschke, Portland, Ore., is chief engineer.

Railway Financial News

CANADIAN PACIFIC.—It is reported that this company has bought the Lake Erie & Northern, which runs from Port Dover to Galt, Ont., 27 miles.

CHICAGO & EASTERN ILLINOIS.—The Bankers Trust Company, New York, as trustee for the refunding and improvement mortgage, has filed in the federal court at Chicago a suit for the enforcement of the mortgage and sale of the property. "The filing of the bill is intended not as a hostile move but as one of the usual and necessary formal steps in connection with the ultimate reorganization of the property.

CHICAGO, INDIANAPOLIS & LOUISVILLE.—A mortgage for $4,000,000 has been filed by the company in Indiana; and a mortgage for $2,000,000 has been filed by the Wabash Valley, a short new line which was recently bought by the C. I. & L. It is reported that a connection will be built at Hammond, Ind., about ten miles long.

GREENVILLE & KNOXVILLE.—See Greenville & Western.

GREENVILLE & WESTERN.—This is the name of the company which is to operate the property of the Greenville & Knoxville, which was recently sold at auction.

KANSAS CITY, MEXICO & ORIENT.—Creditors said to have claims aggregating about $700,000 have secured a temporary injunction against the transfer of the property of this road from the receivers to the new proprietors; and it is said also that the Public Utilities Commission of Kansas will refuse to authorize the new company to do business until its capitalization has been investigated.

The new company, organized in connection with the purchase of July 6, has the same name as the old one, and the charter provides for $50,000,000 of stock and $31,000,000 of bonds.

MARIETTA, COLUMBUS & CLEVELAND.—The property of this company was on July 10 put into the hands of a receiver, suit having been filed by the Columbia-Knickerbocker Trust Company, of New York, trustee of a mortgage for $250,000 on which interest has been in default for several years. The court appointed Daniel B. Torpy, of Marietta, receiver. This line runs from Marietta, Ohio, westward 45 miles to Palos, connecting at the eastern end with the Pennsylvania and the Baltimore & Ohio, and at the western end with the Kanawha & Michigan and the Toledo & Ohio Central.

NEW YORK, NEW HAVEN & HARTFORD.—The special report made by the Interstate Commerce Commission to the Senate concerning the affairs of this company, made public this week, is noticed on a preceding page. Simultaneously with this announcement comes the report from Boston that a well-known law firm, representing stockholders not named, will enter suit to recover untold millions on account of alleged mismanagement of the company in former years.

It is reported in Washington that the attorney general is disposed to defer his proposed suit against the New Haven, charging violation of the anti-trust law, until the directors shall have had more time to consider what action they will take under the recently enacted law of Massachusetts.

COAL FOR RUSSIAN RAILWAYS.—The finance and trade commission of the Russian Imperial Duma has consented to the prolongation of the free importation of coal intended for use on railways.

PURCHASES OF ROLLING STOCK FOR THE FRENCH RAILWAYS.—In the year 1913, the French home and colonial railways placed orders for 1,485 passenger cars, valued at about $10,000,000, and for 13,768 baggage and freight cars having an estimated value of $13,000,000, or in all $23,000,000. Orders were also given for 260 locomotives and 165 tenders at a price of about $8,000,000. In 1912, on the other hand, the orders for locomotives and tenders amounted to $13,000,000.